2009

Clear Lake and Smithport Lake

Watershed Implementation Plan

Louisiana Department of Environmental Quality

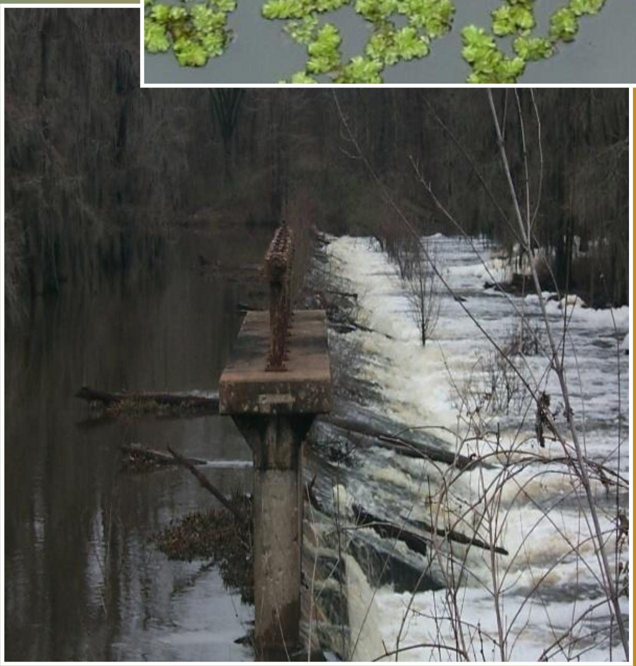

Figure 1 Clear Lake/Smithport Lake Forest

Figure 2 Clear Lake/Smithport Lake Forest

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1.0 Introduction

In Louisiana we are blessed with beautiful and abundant waters to enjoy fishing, hunting, boating or just relaxing by the shore of a lake, river or bayou. Surface water resources stretch for miles of freshwater swamps, streams, bayous, rivers and lakes. Water has always been important to the history and development of Louisiana. Surface water resources in Louisiana are used for a wide variety of purposes including human consumption, agricultural irrigation, transportation, industrial processes, recreation, seafood production, wildlife and so much more. A great portion of the Louisiana economy and cultural heritage is directly linked to the surface water resources that exist today.

According to the United States Environmental Protection Agency, nonpoint source pollution (NPS), unlike pollution from industrial and sewage treatment plants, comes from many different sources, such as rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even our underground sources of drinking water. These pollutants can include: excess fertilizers, herbicides, and insecticides from agricultural lands and residential areas; oil, grease, and toxic chemicals from urban runoff and energy production; sediment from improperly managed construction sites, crop and forest lands, and eroding stream banks; salt from irrigation practices and acid drainage from abandoned mines; bacteria and nutrients from livestock, pet wastes, and faulty septic systems; and atmospheric deposition and hydromodification; The effects of nonpoint source pollutants on specific waters vary and may not always be detrimental. However, states report that nonpoint source pollution is the leading remaining cause of water quality problems for those water bodies that have been fully assessed. In addition, it is known that these pollutants can have harmful effects on drinking water supplies, recreation, fisheries, and wildlife. In most instances, nonpoint source pollutants are mitigated through the installation and adoption of best management practices, as a series of structural and behavioral practices that are designed to reduce the flow of pollutants into watersheds. Best management practices may include the construction of urban wetlands, the creation of vegetated buffer zones next to drainages or riparian areas, and responsible use of fertilizers and pesticides. Education programs and campaigns for urban landscaping and agricultural practices are also considered best management practices.

Major efforts are now underway in Louisiana to improve the quality of surface waters. State and federal agencies, universities, industry, business and citizen groups have formed a wide variety of partnerships to move forward in solving water quality problems in the state. Water quality solutions are often complicated and require cooperation of all the stakeholders within the watershed.

Figure 3 A butterfly in the Clear Lake/Smithport Lake Watershed

The Louisiana Department of Environmental Quality (LDEQ) has identified Clear Lake/Smithport Lake as a waterbody that does not meet all of its water quality standards, and as a result, it was placed on the State of Louisiana's 2004 303(d) list. According to the LDEQ assessment, the suspected causes of impairment to the waterbody are dissolved oxygen and nutrients, stemming from natural conditions. An intensive survey of the lakes was conducted, and in June 2007, a Total Maximum Daily Load Report (TMDL) was prepared for the Clear Lake/Smithport Lake Watershed,

Figure 4 Smithport Lake Dam with water. Picture taken on February 2, 2005

including Na Bonchasse Bayou, Siphoriem Bayou, Rambin Bayou, Caney Bayou, and Clear Lake, by the Louisiana Department of Environmental Quality (LDEQ). The TMDL summarized the maximum amount of a pollutant that Clear Lake/Smithport Lake can assimilate and still meet water quality standards for its designated uses, in addition to providing the goals for the reduction of those pollutants. Summer and winter projections of Clear Lake/Smithport Lake were modeled to quantify the point source and nonpoint source waste load reductions necessary so that the lakes would comply with its established water quality standards and criteria.

Section 319 of the Clean Water Act (PL 100-4, February 4, 1987) was enacted to specifically address problems attributed to nonpoint sources of pollution. Its objective is to restore and maintain the chemical, physical, and biological integrity of the nation's waters (Sec. 101; PL 100-4).

The Louisiana Department of Environmental Quality is presently the designated lead agency to implement the Louisiana State Nonpoint Source Program. The LDEQ Nonpoint Source Program and the Louisiana Department of Agriculture and Forestry (LDAF) provide §319(h) funds to assist in the implementation of BMPs to address water quality problems on subsegments listed on the §303(d) list. USEPA §319(h) funds are utilized to sponsor cost sharing, monitoring, and education projects. These monies are available to all private, profit and nonprofit organizations that are authentic legal entities, or governmental jurisdictions. Most of the cleanup effort will initially be focused on those watersheds in the state with the most serious water quality challenges.

This watershed plan lays out a course of action that can be implemented with the prospect that nonpoint source (NPS) pollution in the watershed may be reduced such that the streams, lakes, bayous and rivers meet the water quality standards. This plan will be the basis for outlining how and where the State and the local cooperators should focus their efforts and future resources within the watershed in order to re-attain its designated uses and improve water quality. In trying to improve and protect water quality, all residents and all interested government parties should partake in public education, in hopes that they will support the efforts to implement the best management practices (BMPs). In agricultural watersheds, such as Clear Lake/Smithport Lake, the implementation of activities include paved roads, riparian buffers, septic system inspection, educational outreach, fencing, and the introduction of biological controls to reduce invasive species. Hydromodification and forestry were also shown to contribute to low DO conditions, so best management practices for these nonpoint source pollutant sources will also be presented in this plan. A consolidated list of recommended BMPs for crop agriculture and other land uses can be found in the State of Louisiana Water Quality Management Plan, volume6, http://nonpoint.deq.louisiana.gov/wqa/default.htm.

2.0 Clear Lake/Smithport Lake Land Use

Clear Lake and Smithport Lake (subsegment 100605) are located in the Red River Basin. This basin is comprised of a variety of land uses, stages of development and habitat types, which all contribute to the nonpoint source pollution loads to this watershed. The Red River Basin is located in the northwestern portion of the state and consists of forests, row crop agriculture, pastures and urban areas. The Red River Basin has a substantial number of water bodies not fully meeting its uses.

The 2006 Integrated Report (IR) indicated that dissolved oxygen and mercury were the primary reasons for the fish and wildlife propagation use not being met. Of the 50 water quality sub-segments, 34 were not meeting the fish and wildlife propagation use. There are a wide range of causes for these impairments, including: municipal point sources, package treatment plants, small flows, residential areas, irrigated and non-irrigated crop production and natural conditions.

The Red River Basin extends from its headwaters in Eastern New Mexico through Texas, Oklahoma, Arkansas, and Louisiana into the Gulf of Mexico through the Atchafalaya River. With a drainage area exceeding 67,000 square miles (43,000,000 acres) at Alexandria, Louisiana, the Red River Basin accounts for about 15% of the entire NRCS South Central Region. Approximately 120 counties and parishes, represented by an equal number of Conservation Districts, are located partially or completely in the basin. Below Alexandria, the river flows through a flat alluvial plain, which is subject to backwater flooding during periods of high water.

The area of subsegment 100605 is sparsely populated, and is typical of the basin and is primarily comprised of forestry, as depicted in Table 1, page 10. There is a dam located along the southeast border of the subsegment. A detailed land cover map of subsegment 100605 can be found in Figure 6, page 9. Average annual precipitation in the segment, based on the nearest Louisiana Climatic Station, is 52 inches based on a 30-year period of record.

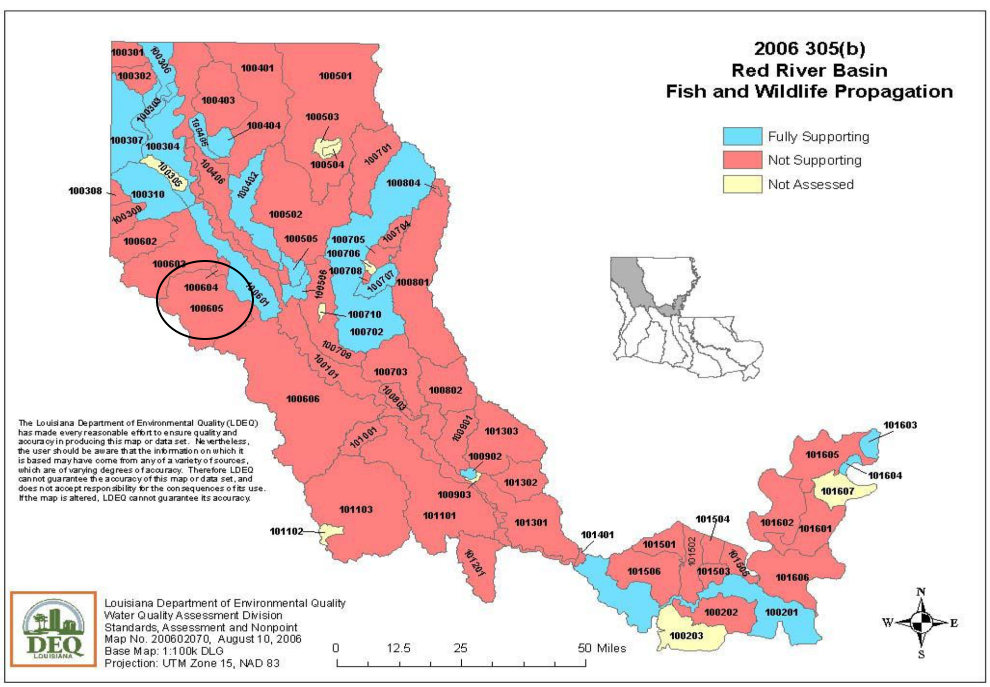

Figure 5 Red River Basin Fish and Wildlife Propagation Map

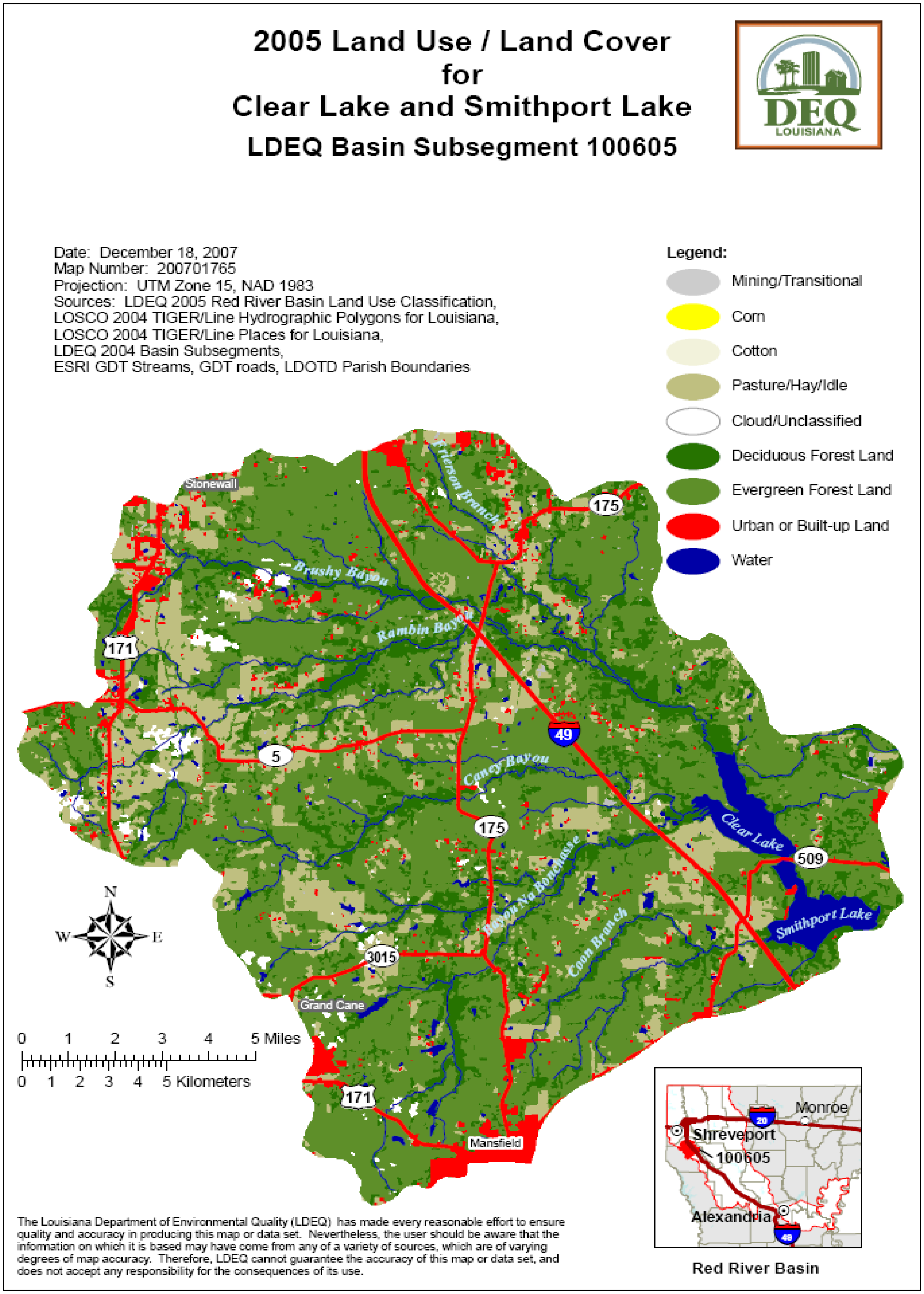

Figure 6 Clear Lake/Smithport Lake Land Use Map

Land Use	Acres	Percent
Cloud	1545.4747	1.18%
Cotton	17.461857	0.01%
Deciduous Forest	22901.32581	17.43%
Developed/Urban	6000.456056	4.57%
Evergreen Forest	78870.79243	60.01%
Floating Aquatics	13.447637	0.01%
Gravel Pit	392.992138	0.30%
Oil/Gas	67.639607	0.05%
Pasture	20688.88846	15.74%
Water	923.069889	0.70%

Table 1 Clear Lake/Smithport Lake Land Use

2.1 Clear Lake/Smithport Lake Watershed Description

Smithport Lake and Clear Lake are impounded bottom land lakes created by a dam at the southern end of Smithport Lake. Subsegment 100605 includes Clear Lake/Smithport Lake and also the area from just below the lakes to the Red River. Clear Lake and Smithport Lake (subsegment 100605) have a total area of approximately 2800 acres. Clear Lake is located in northwestern Louisiana about 10 miles east of Mansfield. It is approximately 1,410 acres in size and is one mile wide and three miles long. The lake begins at Rambin Bayou and ends at the Hwy 509 Bridge. This is definitely not a recreational boating lake. It is a "Louisiana look" lake as it is full of moss covered cypress trees, some scattered, some thick. It is a locally popular fishing lake, and there is only one access to this lake on highway LA 509. Smithport Lake is located in northwest Louisiana 10 miles east of Mansfield. It is approximately 1,410 acres in size and is two miles wide and two miles long. The lake starts at the Hwy 509 Bridge and goes to the Smithport Dam. It is a wooded lake and not for recreational boating. It is a very scenic lake, and there is only one good access on highway LA 509. The lake is very shallow and wide and is heavily forested. The shallower parts are extensively affected by submerged aquatic vegetation. An earthen dam built in 1953 has a top elevation of 142.0 feet above sea level and is 2, 500 feet in length. Lake level is controlled by a 600-foot-long concrete spillway, at a crest elevation of 131.6 feet above sea level. The Shreveport/Mansfield Office of the NRCS was able to take LDEQ on a tour of the area on November 5, 2008. All pictures were taken during that visit unless dated February 2, 2005, in which case they were taken during the watershed survey. Details of the visit are noted throughout the plan.

2.2 What is a watershed?

What is a watershed? We all live in a watershed. A watershed is defined as all of the land that drains into a specific river, lake or bayou. Watersheds provide a structured framework for the evaluation and mitigation of water quality impairments. Improving water quality within the framework of a watershed allows

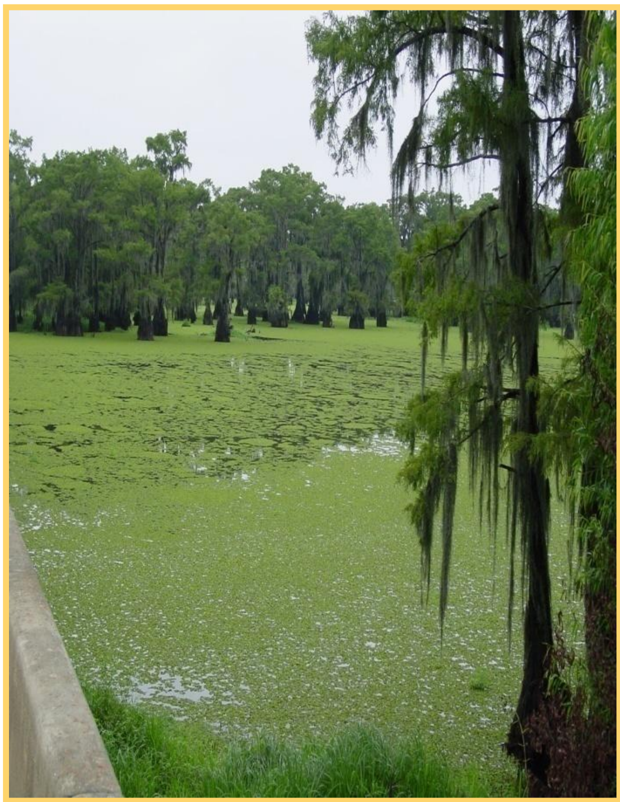

Figure 7 Salvinia in the Clear/Smithport Lake

stakeholders to target implementation in areas that are most likely to contribute to the water quality impairments of a specific water body. A watershed targeted approach increases the likelihood of water quality improvements and results in a higher return investment from water quality funding.

Citizens, local entities, businesses and other stakeholders of the Clear Lake and Smithport Lake Bayou watershed can help to make improvements in water quality. To make lasting and significant changes to the water that is integrated with daily activities, a watershed approach can be the solution. A watershed approach uses hydrologically defined areas to coordinate the management of natural resources. Also, the watershed approach considers all activities within a landscape that affect the health of the watershed. It combines physical geography, biology, chemistry, economics, and social and cultural considerations into decision-making. Local stakeholder input, national and state goals and regulations are all considered in making decisions on improving water quality within a watershed.

The watershed approach recognizes the needs for water supply, water quality, flood control, navigation, hydropower generation, fisheries, biodiversity, habitat preservation, and recreation. It also recognizes that these needs do compete with one another. Using the watershed approach, a plan can be developed for natural resource management by establishing local priorities in the context of national and state goals while coordinating public and private actions. It is a comprehensive resource management tool. Every aspect of a natural resource is covered, from its socio-economic impact to its environmental viability, in supporting biological systems. Environmental assessment, strategic monitoring, the watershed management plan, and the watershed partnership are all major components of the watershed approach.

A watershed partnership is also significant to the watershed approach. Watershed partnerships represent all the stakeholders in the watershed such as local businesses, landowners, city and parish government, state and federal resource agencies, farmers, community groups, water suppliers, developers, and industries. Watershed planning through partnerships can result in more efficient use of financial resources since these resources are shared and therefore work is not duplicated. Citizens working together promote a spirit of cooperation and fairness that can minimize any negative social and economic impacts.

A watershed stakeholder is anyone who lives, works, or recreates in the watershed. These individuals have a direct interest in the quality of the watershed and are affected by planned efforts to address water quality issues. Individuals, groups and organizations within a watershed can become involved as stakeholders in planning and executing initiatives to protect and improve local water quality. Stakeholder involvement is critical for selecting, designing, and implementing management measures to successfully improve water quality. Stakeholders offer the various perspectives of their constituencies and allow for the formation of a plan that is not only feasible but palatable to those most impacted.

2.3 Elements of the Watershed Protection Plan

In promoting watershed based planning, the environmental protection agency (EPA) has outlined nine elements necessary for successful establishment of a watershed protection plan. The following steps provide a template for creation, implementation, and review of watershed protection efforts. While the composition and strategy of watershed protection plans vary, the basic elements should include the following:

1. Identify sources and causes of pollution
2. Estimate necessary load reductions

3. Describe point and nonpoint source management measures
4. Assess the technical and financial assistance needed
5. Design an informational/educational component
6. Develop a schedule of implementation
7. Set interim measurable milestones for progress
8. Establish criteria to determine load reductions
9. Create a monitoring component

The following plan touches on the nine elements although not necessarily in the order presented by the Environmental Protection Agency.

3.0 Water Quality Analysis

Summer and winter projections of Clear Lake and Smithport Lake were modeled to quantify the point source and nonpoint source waste load reductions necessary in order for the lakes to comply with its established water quality standards and criteria. The designated uses and water quality standards for Clear Lake and Smithport Lake are shown in Table 2: Water Quality Criteria and Designated Uses, page 18. The primary standard for the TMDLs was the DO standard of 5 mg/L all year round.

3.1 Water Quality Assessment

Clear Lake/Smithport Lake, subsegment 100605, was on the 2004 303(d) list. The 2002 Louisiana Water Quality Inventory Report (Section 305(b)) showed that the subsegment was found to be "not supporting" its designated use of Fish and Wildlife Propagation. It is, however, meeting its designated use of Primary and Secondary Contact Recreation and Agriculture. Its suspected impairments included cadmium, copper, lead, mercury, non-native aquatic plants, and dissolved oxygen. Clear Lake/Smithport Lake was subsequently

Figure 8 North portion of Clear/Smithport Lake. Picture taken February 2, 2005

scheduled for TMDL development with other listed waters in the Red River Basin. According to the 2004 Integrated Report, Clear Lake/Smithport Lakes were still fully supporting its designated use of Primary and Secondary Contact Recreation and Agriculture, but still were not supporting Fish and Wildlife Propagation. Its suspected causes of impairment in 2004 were Nitrate/Nitrite, Non-Native Aquatic Plants, Dissolved Oxygen, and Total Phosphorus, all based on natural conditions. New data, however, showed attainment for the former suspected causes of impairment (cadmium, copper, lead, and mercury). The change in assessment result was likely due to changes in metal sampling methods (modified clean-technique metals sampling), not BMPs or any other changes in the watershed. Again, in the 2006 Integrated Report (IR) Clear Lake/Smithport Lake still showed attainment based on new data for the former suspected causes of cadmium, copper, lead, and mercury. In addition, it was also fully supporting its designated uses of Primary and Secondary Contact Recreation and Agriculture. However, the subsegment was still not supporting Fish and Wildlife Propagation and its suspected causes were still Nitrate/Nitrite, Non-Native Aquatic Plants, Dissolved Oxygen, and Total Phosphorus, all based on natural conditions. According to a District Conservationist from the NRCS Shreveport/Mansfield Office, "natural conditions" would be considered shallow, slow moving water. None of the water in the area is being flushed out, and in most areas, there was no water. According to the 2008 IR, the lakes are still listed for Nitrate/Nitrite, Non-Native Aquatic Plants (Introduction of Non-native Organisms (Accidental or Intentional)), Dissolved Oxygen, and Total Phosphorus, all based on natural conditions. As stated on the 2004, 2006, and 2008 303(d) reports, a use attainability analysis (UAA) is needed for this subsegment.

3.1.1 What is a Use Attainability Analysis?

Designated uses can be changed or removed with appropriate analysis and documentation. To support making such a change, a State or Tribe may be required to conduct a "use attainability analysis." A use attainability analysis is a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors.

Setting water quality goals through assigning "designated uses" is best viewed as a process for states and tribes to review and revise over time rather than as a one-time exercise. A key concept in assigning designated uses is "attainability," or the ability to achieve water quality goals under a given set of natural, human-caused, and economic conditions. The overall success of pollution control efforts depends on a reliable set of underlying designated uses in water quality standards. EPA issued the *Plan for Supporting States and Tribes on Designated Use Issues in 2004*, in an effort to make designated uses a priority, which called for:

- More outreach, training, workshops, and other support for states and tribes on critical issues regarding designating appropriate uses
- Continued discussions with stakeholders on designated use issues

Ultimately, whenever a use change is contemplated, there should be thoughtful and informed public involvement throughout the process. States should communicate to the public about use changes early in the process and EPA should publicly support the states' actions to engage the local community in these discussions of what is attainable. These are important decisions, and the best decisions reflect consideration of all perspectives.

3.1.2 Stream Survey Data

Clear and Smithport Lakes were targeted for surveying with the intention of populating a TMDL Model for oxygen demand substances and pollutants. The simulation was for NaBonchasse Bayou from the Mansfield POTW discharge as well as Clear Lake and Smithport Lake. Two other streams, Siphorien and Caney Bayou, were considered as point sources, and Rambin Bayou was considered as a headwater for the northern end of Clear Lake. The watershed survey was performed by the Watershed Surveys Section, and lasted for three days (08/16/2005- 08/18/2005). The team surveyed the lakes during summer, critical conditions, with the aim of retrieving data to satisfy the scope of the TMDL project. Maps of the survey sites are shown on pages 15, 16, and 17(Figures 10, 11, and 12).

The Watershed Survey Group took water quality samples and in-situ readings throughout the lakes and surrounding tributaries. During the survey, nine continuous monitors were deployed to collect water parameters such as DO, DO% saturation, pH, Temperature, Specific Conductivity, and Salinity. GPS readings were taken prior to and during the survey. Flows were measured with a Flow tracker 6A at sites SL01, RB01, and NBB02.

Both Clear Lake and Smithport Lake have a lot of territory that is difficult to access by boat. On both lakes a survey location was established in the center of the lakes. However, in Smithport

Figure 9 Salvinia in Clear Lake/Smithport Lake

Lake, a central location was just barely accessible by boat. In Clear Lake, it was not accessible by boat due to the dense overgrowth of vegetation and extensive swampy areas. For access to the southern most sample locations in Smithport Lake there is a boat launch located just north of the dam. All of the Bayous were sampled from roads that cross them with the exception of Rambin Bayou and the northern sample of Na Bonchasse Bayou. Rambin Bayou was accessed by ATV through a pipe line right of way from Mount Zion Rd. A small portable boat was needed for sampling purposes once the bayou was reached. The northern sample point for Na Bonchasse Bayou, NBB01, was not surveyed during the reconnaissance survey of Smithport Lake. This was a water quality survey point described in a report from 1985; it is unknown if this site is still accessible.

This watershed has a total of ten dischargers. All dischargers located in the northern half of the subsegment flow into Rambin Bayou. None of these dischargers are major; and from a preliminary model run from the data that was available it was determined that their outputs would return to background numbers before reaching Clear Lake. Therefore Rabin Bayou and its dischargers were not modeled. The Airport Trailer Park discharger also had too small of a discharge at too great of a distance away to affect the lakes. The LI Ready Mix Plant 17 discharge was inactive at the time of the survey. The only discharge that needed to be modeled at the time of the survey was the discharge for the City of Mansfield which had a designed flow of 1.2 MGD.

The Mansfield POTW is a pond system, the discharge from which forms a very short tributary to Na Bonchasse Bayou. At the sample location for the Mansfield Discharger, there are actually three sites, identified as NBB03a, NBB03b, and NBB03c, as shown in the map on page 15, figure 8. There was an upstream site, a discharge site, and a downstream site.

During the survey, it was noted that a weather station needed to be placed in a secure location so that it would be possible to monitor the precipitation and wind speed of this area. The closest agriclimatic stations were located in Bossier Parish (approx. 20 miles away) and Bienville Parish (approx. 35 miles away). Therefore, a weather station was needed to monitor the local weather conditions with better precision.

The Watershed Survey crew did encounter some problems while conducting the survey. The Weather Station that was deployed during the survey did not function properly, but, the weather data could still be obtained from the Shreveport International Airport. Also, site SB01 was not flowing and site NBB01 was not accessible. The Survey crew was not able to collect a cross-section at NBB03C.

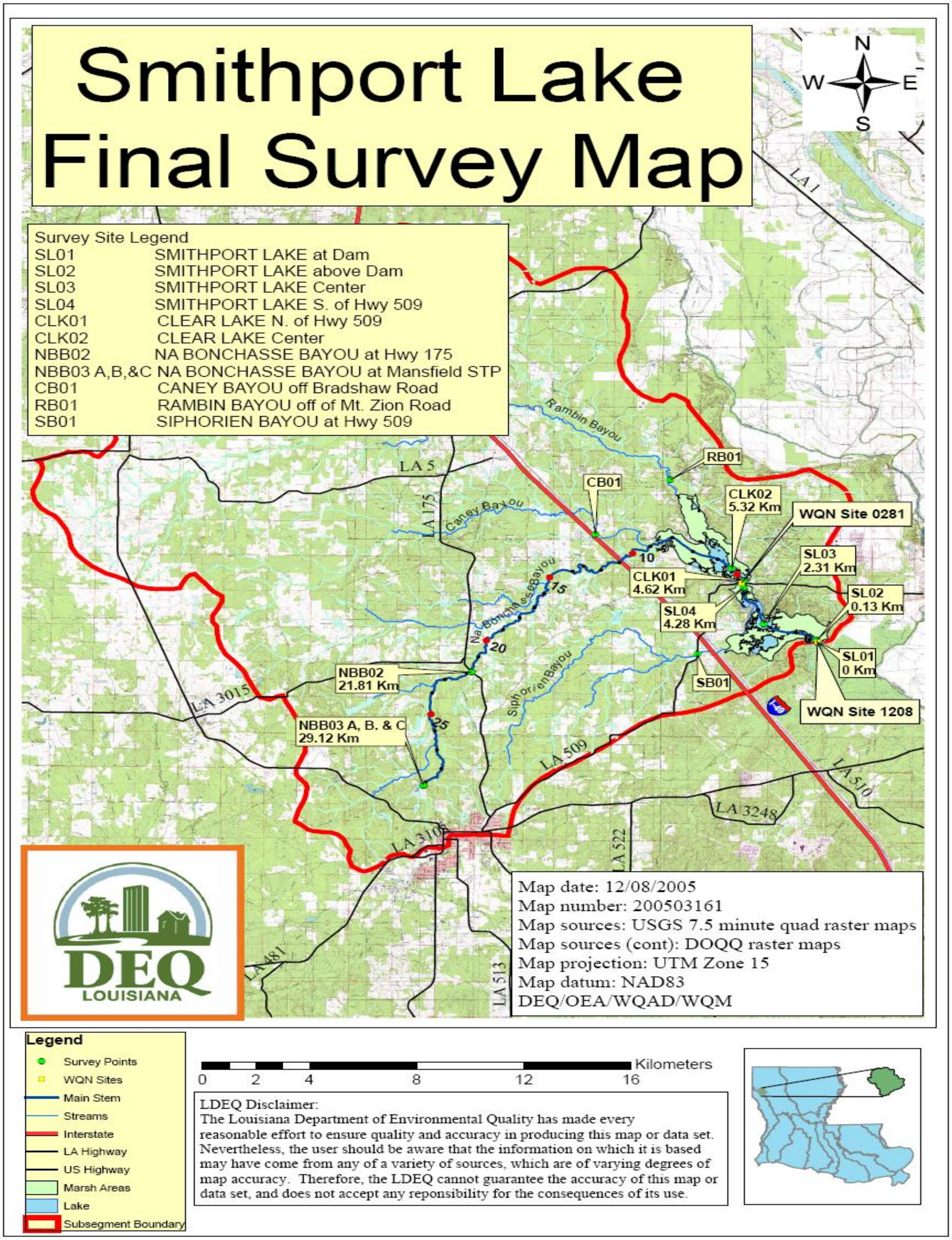

Figure 10 Clear/Smithport Lake Final Survey Map

Lake Edwards (Clear Lake) and Smithport Lake Detail

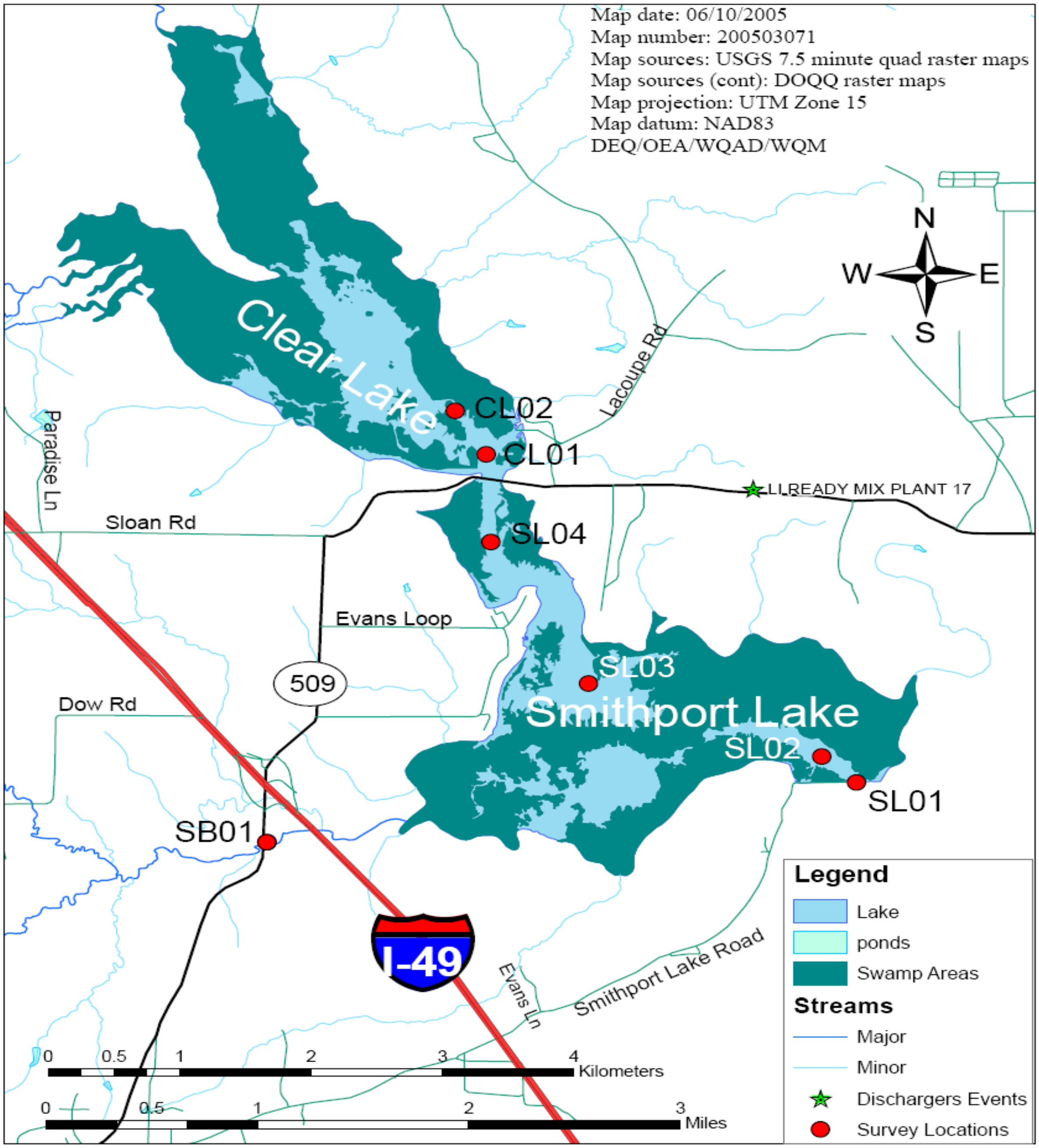

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Figure 11 Clear/Smithport Lake, Lake Detail

Survey of Lake Edwards (Clear Lake) and Smithport Lake Subsegment 100605

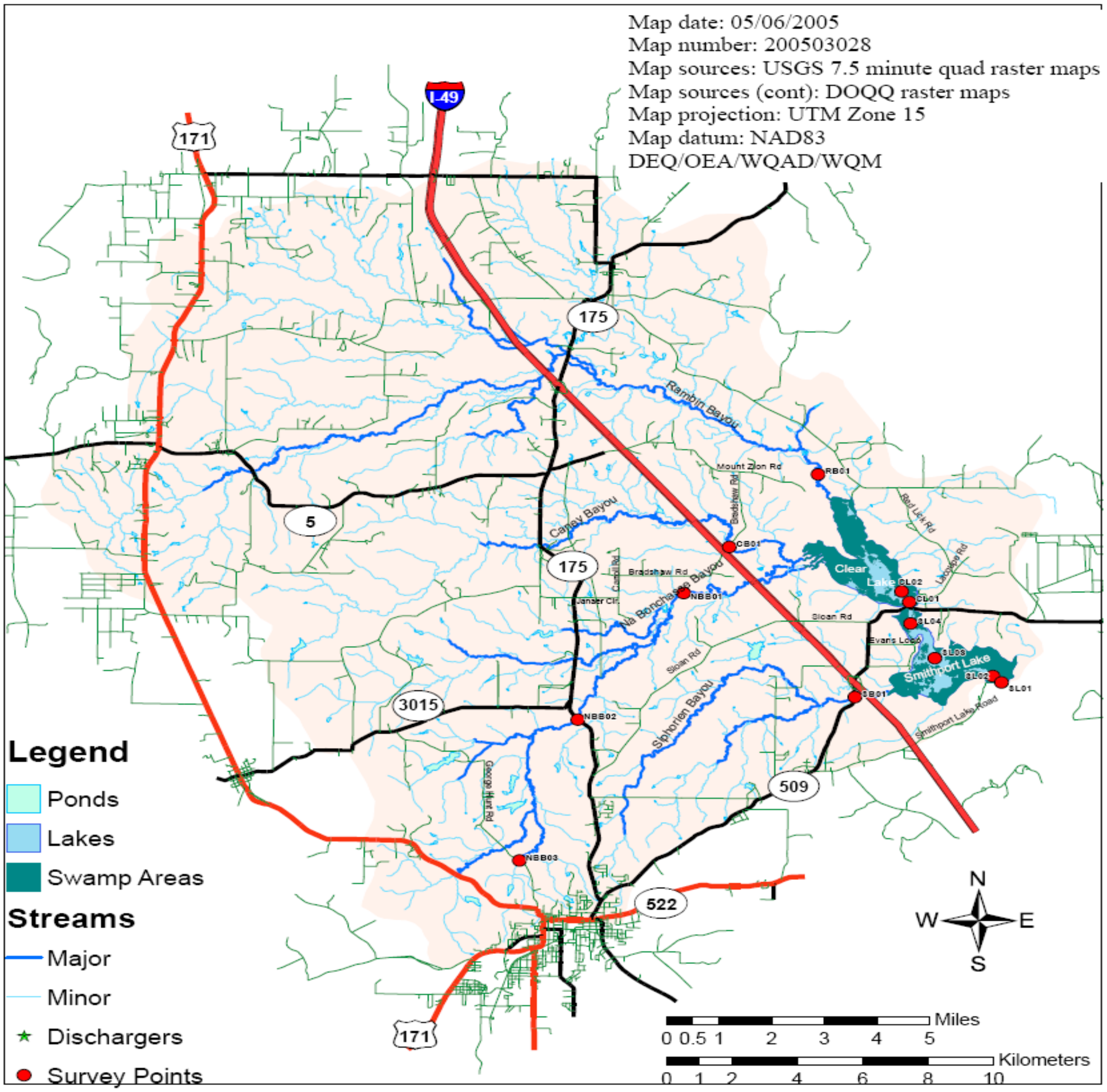

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Figure 12 Clear/Smithport Lake Survey Map

3.1.3 Ambient Data

LDEQ maintained two monthly water quality sampling stations on Clear Lake/Smithport Lake as part of the Statewide Water Quality Monitoring Network. LDEQ Water Quality Site 0281, Clear Lake north of Mansfield, Louisiana, has a period of record from January 1990 to May 1998. LDEQ Water Quality Site 1208, Smithport Lake at spillway, west of Abington, Louisiana, has two periods, January 2002 to December 2002 and February 2004 to September 2005. Data collected during the eularian survey conducted in August 2005, included discharge data, cross-section data, field in-situ data, continuous monitor data, and lab water quality data. Data information was obtained from the Water Quality Assessment Division, Standards and Assessment Division. Graphs of the sampling data are shown on the next few pages. For the months that had more than one sample taken, an average was taken for the samples. The water quality standards for Clear Lake/Smithport Lake are listed in the table below. Water quality standards form the basis for implementing best management practices for the control of nonpoint sources of water pollution.

Figure 13 Area along southern edge of Clear/Smithport Lake

	Value
Designated Uses	A,B,C,F
DO, mg/L	5.0
Cl, mg/L	250
SO_4, mg/L	75
pH	6.0-8.5
BAC	*See Note 1
Temperature, °C	32
TDS, mg/L	500

Table 2 Water Quality Numerical Criteria and Designated Uses

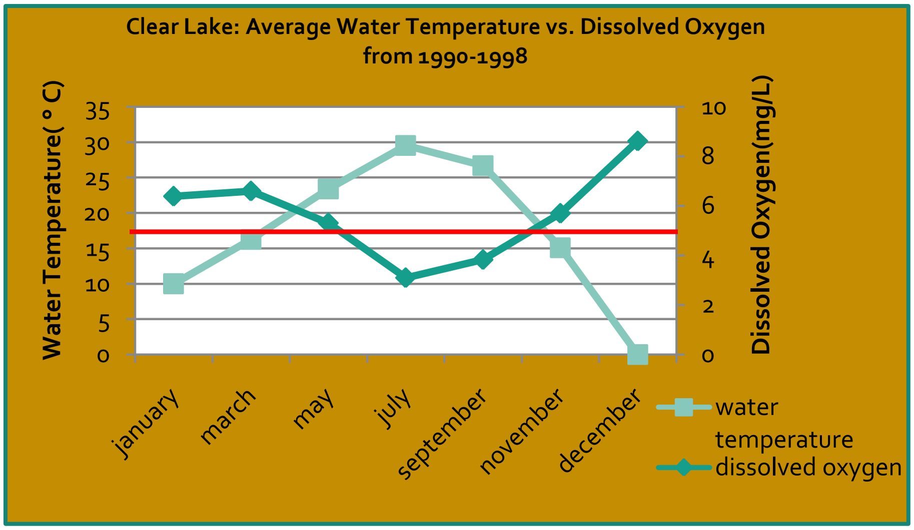
Note 1: 200 colonies/100ml maximum log mean and no more than 25% of samples exceeding 400 colonies/100ml for the period of May through October; 1,000 colonies/100ml maximum log mean and no more than 25% of samples exceeding 2,000 colonies/100ml for the period of November through April

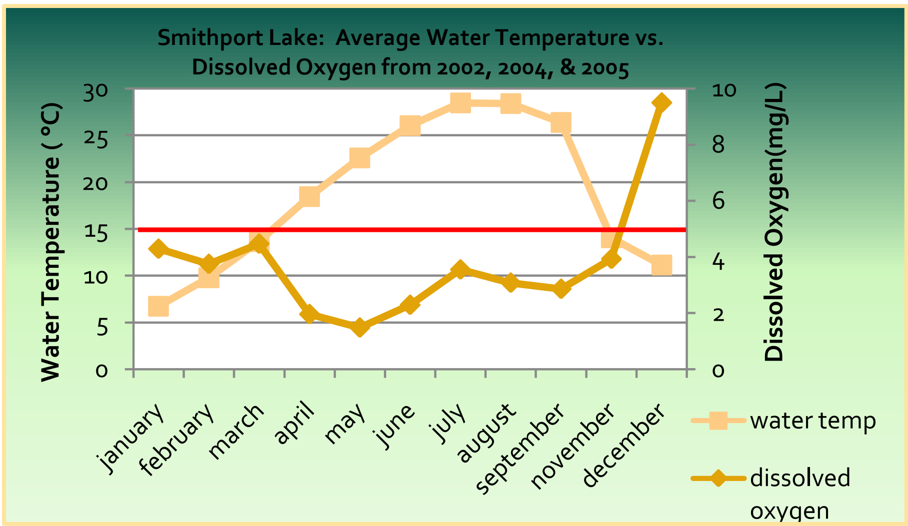
USES: A-primary contact recreation; B-secondary contact recreation; C-propagation of fish and wildlife; D-drinking water supply; E-oyster propagation; F-agriculture; G-outstanding natural resource water; L-limited aquatic life and wildlife use

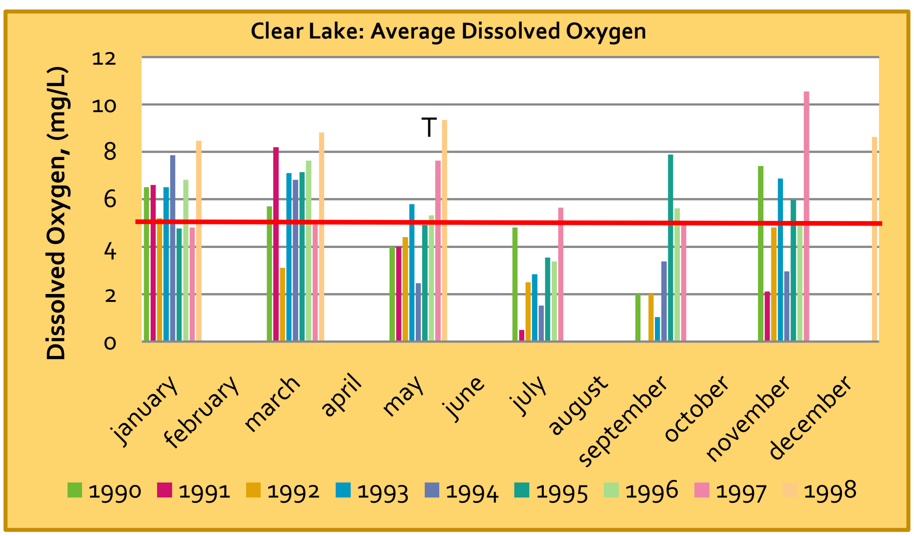
Figure 14 Stretch of Clear/Smithport Lake covered with Salvinia

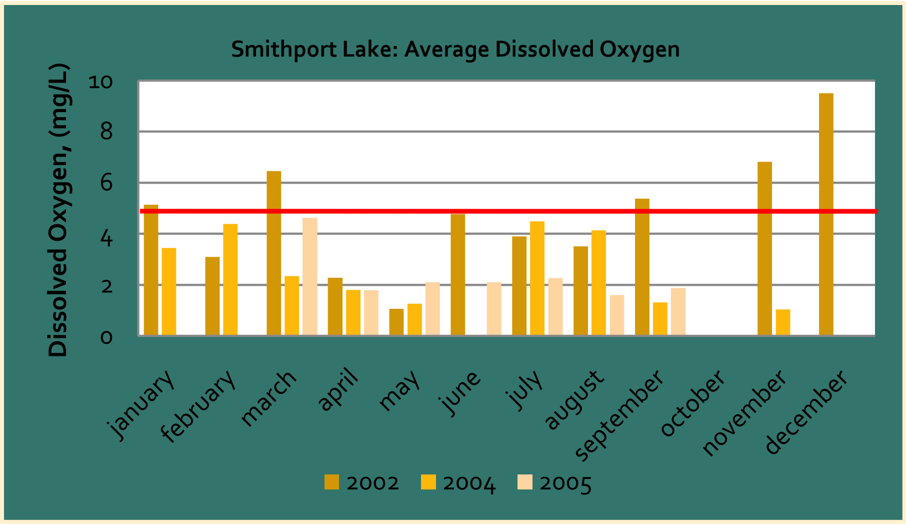
The D.O. monthly average and water temperature data from the years 1990 to 1998 were calculated for Clear Lake and years 2002, 2004, and 2005 for Smithport Lake to construct graphs showing the inverse relationship of D.O. and water temperature. In Clear and Smithport Lakes, this trend was followed as the D.O. increased when the water temperature decreased, and vice versa. The water quality standard of 5.0 mg/L for dissolved oxygen was maintained only during the cooler months (January, March, May, November, and December, in Clear Lake, and only in December for Smithport Lake. Dissolved Oxygen levels reached their lowest in July in Clear Lake when the temperature was the highest. In comparison, for Smithport Lake, when temperatures were milder, dissolved oxygen concentrations were higher, as in November and December.

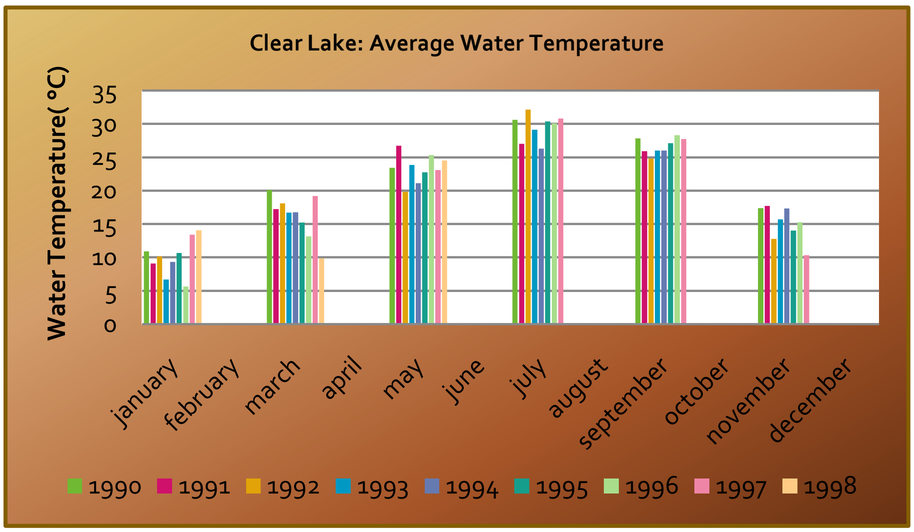
The red horizontal line on some of the graphs depicts the DO standard of 5.0 mg/L. Any value above the line shows attainment, and any value below shows non-attainment.

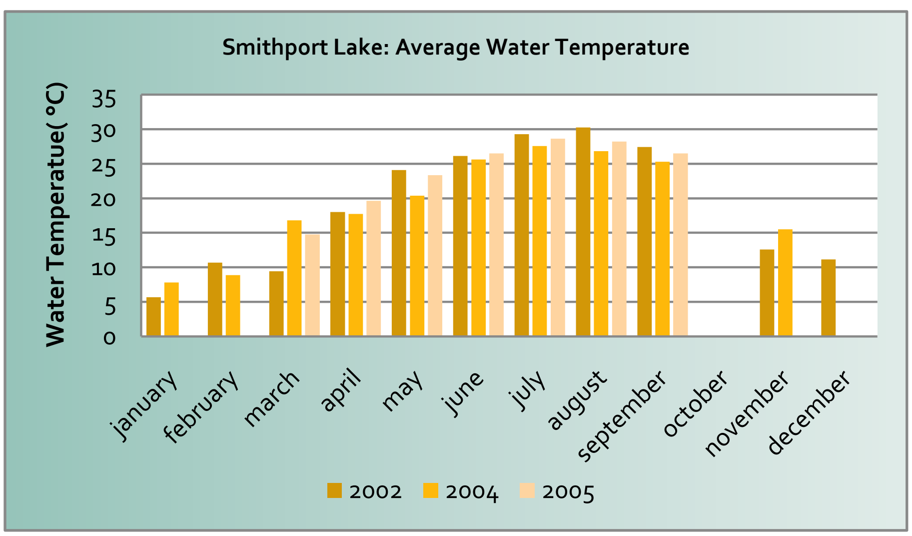








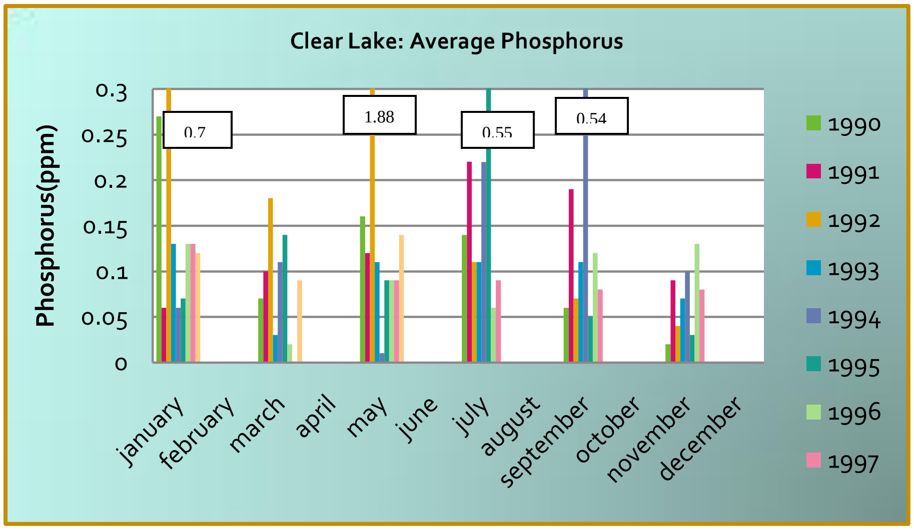




For the remaining charts, the data collected was plotted on the same chart to enable a comparison between the years. This allows similarities of seasonal trends to be seen, and also to see if there is any improvement or deterioration of water quality between the years. Agricultural activities, such as fertilization, irrigation, and tillage, also occur during certain times of the year and, can cause seasonal deterioration of water quality.

Clear Lake's dissolved oxygen levels were the lowest on average in July, when temperatures were highest. Concentration levels were highest in the cooler months, i.e. January-March, and November. The D.O. in Clear Lake seems to be rather stable. In comparing the month of July between the years, it seems that D.O. levels were around 5 in 1990 but from 1991-96, the levels dropped; however, in 1997, levels rose again to almost 6 mg/L. Smithport Lake's dissolved oxygen levels were highest in the cooler months, i.e. November and December 2002; except in November 2004, the D.O. levels were rather low. On average, D.O. levels were lower in the hotter months, i.e. May-July.

Temperature is strongly inversely proportional to dissolved oxygen and moderately inversely proportional to run-off. Dissolved oxygen and run-off are also moderately directly proportional. In both lakes, when D.O. levels increased, water temperatures decreased; when water temperatures increased, D.O. levels decreased.



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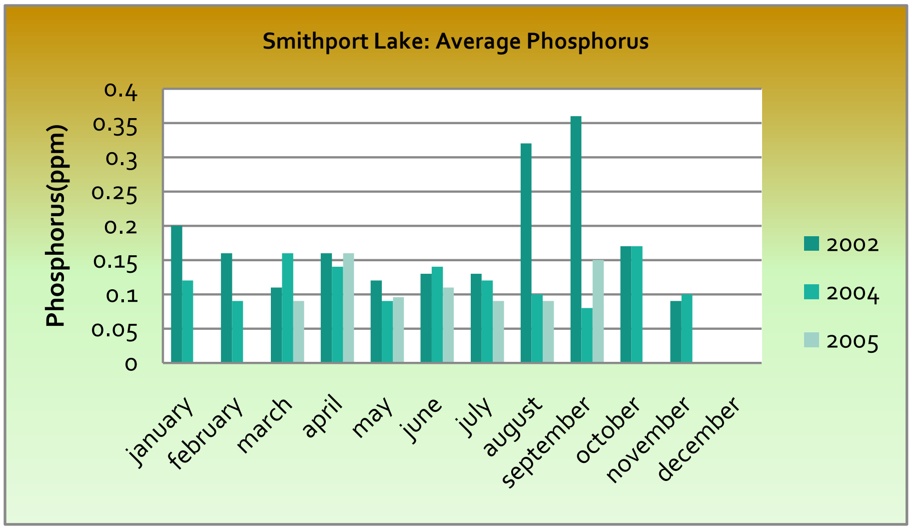
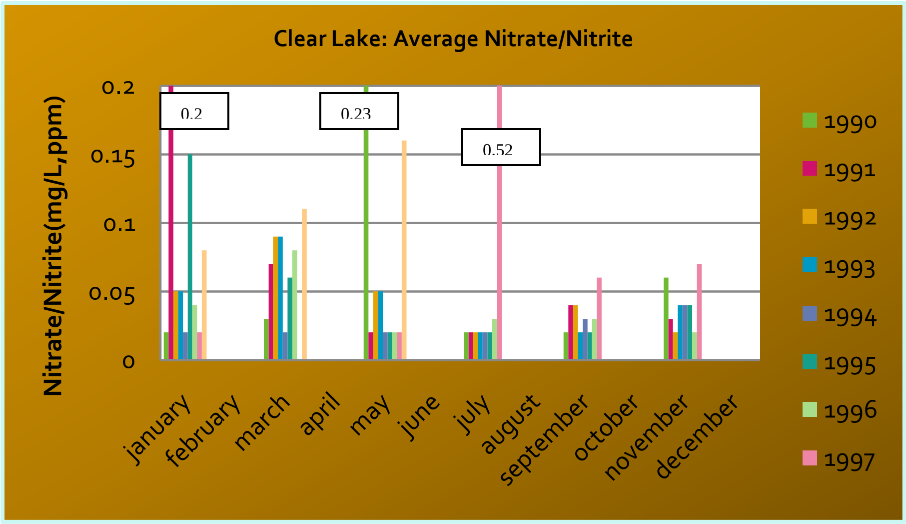
There does not seem to be any change in the water temperature between the years. The data shows that in the winter months, temperatures are their lowest, and in the summer months, they are at their highest.



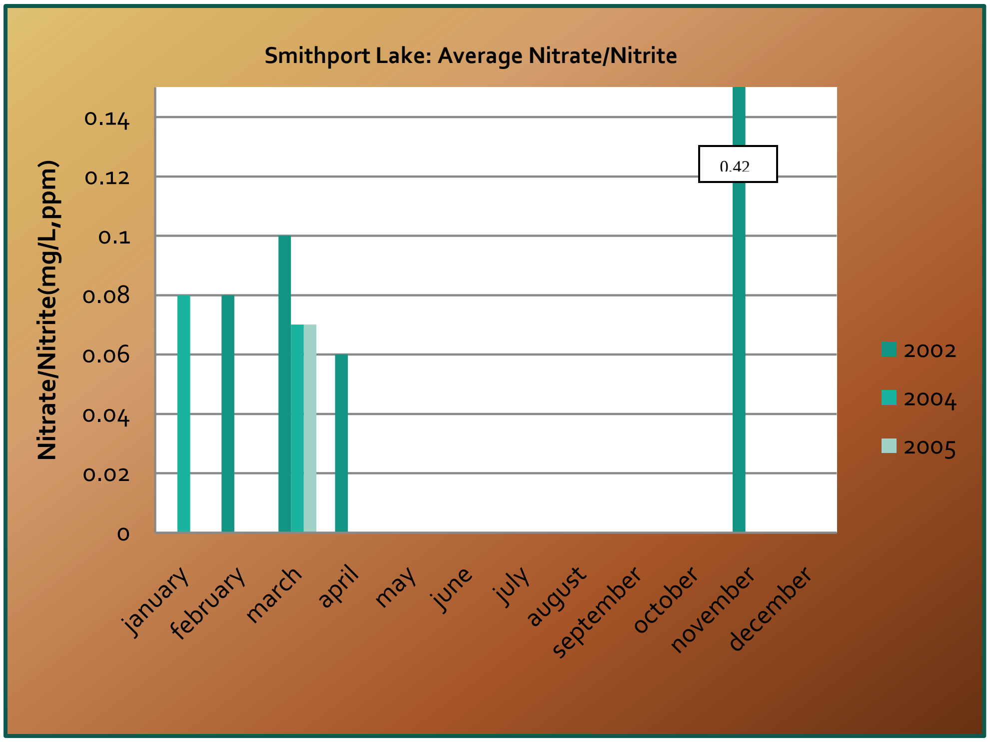
The level of Phosphorus stays steady across the board for the most part except for a few spikes here and there in Clear Lake. In 1992 and 1994, there were sharp increases in phosphorus levels in January, May, July, and September.



In the year 2002, concentrations for phosphorus for Smithport Lake seemed to stay pretty low except for sudden spikes in August and September, which may have been due to agricultural practices.

However, in 2004 and 2005, phosphorus concentrations were even lower than they had been in 2002, and no spikes in concentrations were recorded.

The average levels of Nitrate/Nitrite increased around March, with the highest peak of concentration in July of 1997 for Clear Lake. There were also spikes in concentration in January of 1991 and May of 1990, which may be attributed to a number of things. In general, the overall concentration of nitrate/nitrite was low; the average levels of Nitrate/Nitrite for the Smithport Lake increased in November of 2002 for unknown reasons. It seems that overall, from 2002 to 2005, levels of nitrate/nitrite have been steady.



3.2 Oxygen Depletion and Water Quality

Dissolved Oxygen is a very important indicator of a water body's ability to support aquatic life. Dissolved oxygen analysis measures the amount of gaseous oxygen (O_2) dissolved in an aqueous solution.

Aquatic life depends on oxygen to breathe, as does all life. Fish "breathe" by absorbing dissolved oxygen through their gills. Natural stream purification processes require adequate oxygen levels in order to provide for aerobic life forms. As dissolved oxygen levels in water drop below 5.0 mg/L, aquatic life may be put under stress. Oxygen levels that remain below 1-2 mg/L for an extended period of time can result in fish kills.

There are several factors that contribute to the concentration of dissolved oxygen. Some of these aspects include: volume and velocity of water flowing in the water body; climate and season; the type and number of organisms in the water body; dissolved or suspended solids; altitude; amount of nutrients in the water; organic wastes; riparian vegetation; and groundwater inflow.

Output from the calibration model shows that during the August 2005 survey period, the DO standard of 5.0 mg/L was not being met in any of the modeled reaches. The calibration model minimum DO on the main stem was 0.93 mg/L. The lower concentration of DO in the Clear Lake and Smithport Lake area is contributing to the fact that the lakes are not meeting their designated use for fish and wildlife propagation.

3.3 Nutrients and Water Quality

Eutrophication is defined as the increased rate of primary production, often due to increased nutrient inputs. There have been debates on how much phosphorus- or nitrogen-based compounds contribute to eutrophication at any specific time and/or locale. In either case, however, it is clear that both phosphorus and nitrogen loadings to aquatic systems have increased since pre-industrial times because of increased inputs of phosphate and nitrate-based fertilizers, atmospheric nitrogen deposition and domestic/agricultural waste water runoff.

Figure 15 Clear/Smithport Lake

Nutrient enrichment can result in increased plant/algal biomass in an aquatic ecosystem. The increase in algal biomass can lead to decreased light levels that hinder benthic photosynthetic processes and higher biological oxygen demand (BOD), due to respiration of the large algal biomass and/or consumer biomass (e.g., bacteria and grazers).

Subsegment 100605 is found to be "not supporting" its designated use of Fish and Wildlife Propagation. The suspected causes of impairment are dissolved oxygen and nutrients, with the suspected sources being natural conditions. This may be explained by assuming that nonpoint loading is associated with flows into the stream, which may be responsible for the benthic blanket which accumulates on the stream bottom and that the accumulated benthic blanket of the stream, expressed as SOD and/or resuspended BOD in the calibration model, has reached steady state or normal conditions over the long term and that short term additions to the blanket are off set by short term losses. This accumulated loading has its greatest impact on the stream during periods of higher temperature and lower flow. The only mechanism for changing this normal benthic blanket condition is to implement best management practices and reduce the amount of nonpoint source loading entering the stream and feeding the benthic blanket.

Nutrients are essential to plant growth in a water body, but over-enrichment leads to excessive algae growth, an imbalance in natural nutrient cycles, changes in water quality and a decline in the number of desirable fish species (LDEQ, 2000). When phosphorous and nitrogen are applied in excess, they may move until they reach a water body, and in this case, may become harmful to the water body’s organisms. Soluble nutrients may reach surface waters through runoff and ground waters through percolation, while others may be adsorbed onto soil particles and reach surface waters with eroding soil. Aspects that influence nutrient losses are precipitation, temperature, soil type, kind of crop, type of conservation practices used, nutrient mineralization, and de-nitrification.

4.0 TMDL Findings

The TMDLs for the biochemical oxygen demanding constituents (CBOD, NBOD, and SOD), have been calculated for the summer and winter critical seasons. The TMDL for the Clear Lake/Smithport Lake watershed were set equal to the total stream loading capacity. There is no MOS counted in the TMDL since there was a 100% reduction of man-made NPS. They are presented in the table below.

ALLOCATION	SUMMER		WINTER	
	% Reduction Required	(MAR-NOV) (lbs/day)	% Reduction Required	(DEC-FEB) (lbs/day)
Point Source WLA	0	86	0	415
Point Source Reserve MOS (20%)		22		104
Natural Nonpoint Source LA	40	2,953	40	2,650
Natural Nonpoint Source Reserve MOS (20%)		0		0
Manmade Nonpoint Source LA	100	0	100	0
Manmade Nonpoint Source Reserve MOS (20%)		0		0
TMDL		3,061		3,169

Table 3 Total Maximum Daily Load (Sum of UBOD and SOD) for Clear/Smithport Lake

*****Note 1: UBOD as stated in this allocation is Ultimate BOD. UBOD to BOD_5 ratio=2.3 for all treatment levels Permit allocations are generally based on BOD_5*****

4.1 Nonpoint Sources

Nonpoint source loads which are not associated with a flow can be most easily understood as resuspended load from the bottom sediments and are modeled as SOD, CBOD and NBOD loads. Over the years LDEQ has collected data on heavily impacted streams in Louisiana. It is LDEQ's opinion that much of this loading is attributable to run-off loads which are flushed into the stream during run-off events, and subsequently settle to the bottom in our slow moving streams. These benthic loads decay and breakdown during the year, becoming easily resuspended into the water column during the low flow/high temperature season.

4.2 Other Results

Since the calibrated models indicated that the DO criterion was not being met through the majority of the water body, "No Load" summer scenarios were performed in addition to the traditional summer and winter projections.

4.2.1 No Load Scenario

An individual no load scenario was run for this stream to identify more appropriate criteria. With 100% removal of manmade sources, the minimum DO was 3.36. The TMDL suggested that appropriate criteria should be set at 3.0 mg/l DO or less.

4.2.2 Summer Projection

In reality, the highest temperatures occur in July-August, the lowest stream flows occur in October-November, and the maximum point source discharge occurs following a significant rainfall, i.e., high flow conditions. The summer projection model is established as if all these conditions happened at the same time. Summer critical season projections were run for the current standard of 5.0 mg/L May – November. In order to meet the standard during critical conditions, the model indicated that a 100% reduction of man-made nonpoint source loading and a 40% reduction of background loading was necessary. With these percent reductions in the benthic oxygen loads, Clear Lake/Smithport Lake could meet the dissolved oxygen criterion. The minimum DO on the main stem is 4.84 mg/L. Table 4, page 25, shows the nonpoint sources in Clear Lake/Smithport Lake.

Nonpoint Sources

Reach	Reach Name	Length of Reach,km	UCBOD1, kg/day	NBOD, kg/day	Data Source
1	Bayou Na Bonchase at Mansfield STP Discharger to Bayou Na Bonchase at Hwy 175	7.3	15	0.59	100% reduction of man-made sources
2	Bayou Na Bonchase at Hwy 175 to Rambin Bayou Intercept	15.8	11.4	1.14	100% reduction of man-made sources
3	Rambin Bayou intercept to Center of Clear Lake	0.7	190.8	4.91	100% reduction of man-made sources
4	Center of Clear Lake to Clear Lake north of Hwy 509	0.7	166.8	4.17	100% reduction of man-made sources
5	Clear lake north of Hwy 509 to Smithport Lake south of Hwy 509	0.3	27.4	0.55	100% reduction of man-made sources
6	Smithport Lake south of Hwy 509 to Center of Smithport Lake	2.0	392.6	72.55	100% reduction of man-made sources
7	Center of Smithport Lake to Smithport Lake Dam	2.3	610.6	25.71	100% reduction of man-made sources

Table 4 Nonpoint sources, Clear/Smithport Lake

4.2.3 Winter Projection

The winter projection model accounts for the seasonal differences in flows and BMP efficiencies. The results of the model show that the water quality criterion for dissolved oxygen of Clear Lake/Smithport Lake of 5.0 mg/l can be maintained during the winter critical season. The minimum dissolved oxygen is 5.08 mg/l. To achieve the criterion, the model assumed a 100% reduction from all man-made nonpoint sources and a 40% reduction of background loading.

5.0 Identification of High Priority Areas

These areas were selected based on the land use type and water quality information within the Clear Lake and Smithport Lake. High priority areas for this watershed are mainly forested areas draining into the lakes; septic systems from homes on the lakes that may be potentially draining into the lakes; pasture land with grazing animals near the lakes; non-native aquatic plants; forest roads; and areas affected by hydromodification. All of these sources play a part, whether small or large, in affecting the concentration of dissolved oxygen levels. These sources are a high priority for a broad array of conservation activities, which include at least one of the following: watershed-level protection efforts, reforestation of banks and riparian areas with native vegetation, livestock management, maintenance or restoration of natural flow and temperature regimes, and repair, replacement and proper maintenance of on-site sewage systems. It is important to realize that the high priority areas list is only a starting point to guide conservation efforts. Additional information on land cover, land use change, nearness to existing protected areas, water quality, location of impoundments and other factors should also be considered when defining conservation priorities. Foremost, many of these "non high-priority" waters may be added to the list in the future as new information becomes available. Similarly, because of the inherent connectivity in aquatic and coastal ecosystems, degradation of one system may impact another.

6.0 Sources of Nonpoint Source Pollution Loading

6.1 Forestry

About 77% of the total surface area in Clear Lake and Smithport Lake is comprised of forests. There are two forest types in this area, including: deciduous (17.43%) and evergreen (60.01%). Evergreen is the largest forest type, encompassing more than half of the forest region. An evergreen forest is a forest consisting entirely or mainly of evergreen trees that retain green foliage all year round. These forests are dense, multi-layered and harbor many types of plants and animals.

Forested areas contribute a fair share of nonpoint source pollution, which may be caused by water movement over and through the surface of the land. The runoff picks up and transports natural and man-made pollutants, and they are then transported into rivers, streams, lakes, wetlands, coastal waters, and ground water. Herbicides, insecticides, and fungicides are used to control forest pests and undesirable plant species, but can be toxic to aquatic organisms. Pesticides that are applied to foliage or soils, or are applied by aerial means, are most readily transported to surface and ground waters. Some pesticides with high solubility's can be extremely harmful, causing either acute or chronic effects in aquatic organisms, including reduced growth or reproduction, cancer, and organ malfunction or failure. Other "chemicals" that may be released during forestry operations include fuel, oil, and coolants used in equipment for harvesting and road-building operations.

Forested areas can serve as natural wetlands which are uniquely suited to mitigate the negative impacts of nonpoint source pollution. Their landscape position and biogeochemical properties give them both the opportunity and mechanisms to alter pollutant loadings to aquatic ecosystems. However, they can not eradicate all of the pollution, including the dead leaves, decomposed trees and organic matter by themselves. The aforementioned wastes, along with other nonpoint pollution that may contribute to the area are carried into the lakes during storm events. Harvesting may be one way that pollution is increased in this area, and care should be taken to ensure proper forestry best management practices.

6.2 Pasture & Animals

Pasture land makes up approximately 15.74% of Clear Lake and Smithport Lake's land use. Pasture land is land with herbaceous vegetation cover used for grazing of livestock as part of a farm or ranch. Prior to the beginning of mechanized farming, pasture was the primary source of food for grazing animals such as cattle and horses. It is still used extensively, particularly in arid regions where pasture land is unsuitable for any other agricultural production. In more humid regions, pasture grazing is exploited extensively for free range and farming. Pasture growth can consist of grasses, legumes, other forbs, shrubs or a mixture. Soil type, minimum annual temperature, and rainfall are important factors in pasture management.

Figure 16 Cattle grazing along Clear/Smithport Lake

Confined and unrestricted livestock animals can potentially be major sources of animal waste. Runoff from poorly managed facilities can carry pathogens (bacteria and viruses), nutrients, and oxygen-demanding substances that contaminate Clear and Smithport Lakes, causing major water quality problems. Ground water can also be contaminated by seepage. Unrestricted livestock access to the lakes can bring about many negative environmental effects. Livestock defecating in streams that may lead to the lakes may deposit harmful pathogens in them. Poorly managed riparian grazing can lead to loss of streamside vegetation (cover), resulting in elevated stream water temperatures and increased nutrients and sediment in the stream. Grazing in the riparian zone and unrestricted stream access increases streambank instability and erosion and can potentially lead to changes in stream flow patterns. Discharges can be limited by storing and managing facility wastewater and runoff with an appropriate waste management system. For Clear Lake and Smithport Lake, grazing animals, cattle, beef cow, horses, etc., are adding to the runoff from the fields, and it all drains into Clear Lake and Smithport Lake.

6.3 Hydromodification

Figure 17 Water leaving Clear/Smithport Lake through the dam and entering Bayou Pierre Lake

The construction of dams affects many ecological aspects of a lake. Lakes depend on and tolerate a certain pattern of disturbance. Dams slow down this disturbance rate and may damage or destroy this pattern of ecology. Dams can also create problems with the

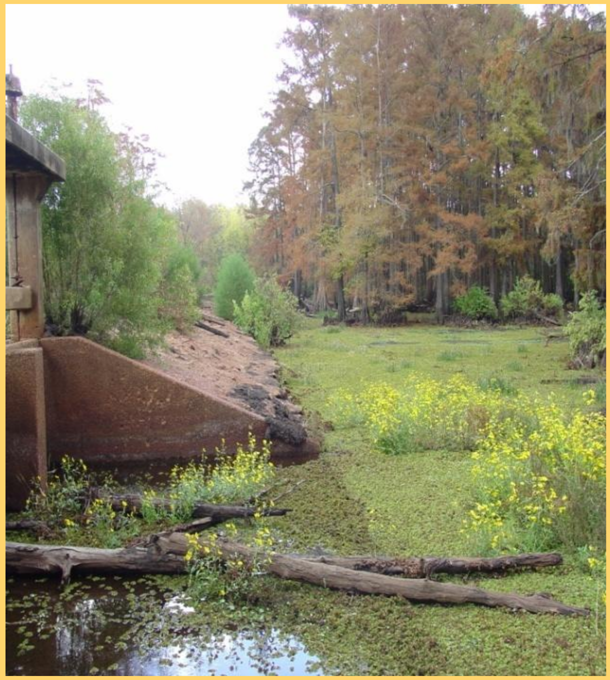


Figure 18 Water entering Bayou Pierre via the Smithport Dam

temperature of the water. Lakes tend to have fairly homogeneous temperatures; whereas, reservoirs have layered temperatures, which are warm on the top and cold on the bottom. Often it is water from the colder (lower) layer which is released downstream; therefore, this water may have a different dissolved oxygen concentration than before. Organisms depending upon a regular cycle of temperatures may be unable to adapt to these cooler temperatures and the balance of other fauna (especially plant life and microscopic fauna) may be affected by the change of oxygen content in the water. According to recent studies, reservoirs contribute to greenhouse gas emissions as well. The initial filling of a reservoir floods the existing plant material, leading to the death and decomposition of the carbon-rich plants and trees. The rotting organic matter releases large amounts of carbon into the atmosphere. The decaying plant matter itself settles to the non-oxygenated bottom of the stagnant reservoir, and the decomposition--unmitigated by a flow pattern that would oxygenate the water--produces and eventually releases dissolved methane.

Dam construction also blocks the flow of sediment downstream, leading to downstream erosion of these depositional environments, and increased sediment build-up in the reservoir. While the rate of sedimentation varies for each dam and each river, eventually all reservoirs develop a reduced water-storage capacity due to the exchange of storage space for sediment.

Another problem with dams is that some older dams often lack a fish ladder, which keeps many fish from moving up stream to their natural breeding grounds, causing failure of breeding cycles or blocking of migration paths. Even the presence of a fish ladder does not always prevent a reduction in fish reaching the spawning grounds upstream. A large dam can cause the loss of entire ecospheres, including endangered and undiscovered species in the area, and the replacement of the original environment by a new inland lake.

The Smithport Dam is located along the southeast border of the subsegment. Its original purpose was flood control. At most, it can hold approximately 8 feet of water from bottom to top. By having the gates open, water and salvinia have gotten on both sides of the dam, including in the forested wetlands. There is salvinia growing everywhere in this area. On one side of the dam is Smithport Lake, and on the other is Bayou Pierre Lake; eventually, the water from this area flows into Bayou Pierre when the water levels get high. The water level near the dam was very low during the site visit. There were logs and debris stuck in the dam amidst the salvinia.

6.4 Non-Native Aquatic Plants

Non-native (or exotic) species are plants or animals that were brought to an area from another region. Many of these species do not have natural predators to keep their populations under control and as a result they often spread rapidly. A species that is able to invade and alter or disrupt an ecosystem is considered invasive. Many exotic plants grow rapidly, displacing the native plants and animals, resulting in a loss of biodiversity. Native plants are an essential part of the aquatic ecosystem, providing food, shelter and oxygen for other aquatic life. Some species have roots that stabilize the shore line, absorb nutrients and toxins and slow the flow of sediments into a waterbody. In addition to impacting native populations, exotic plants often form dense mats of vegetation that can impede boating, fishing and other recreational activities. Aesthetic appeal and property values frequently decline when an exotic species takes over. Exotic species were introduced to our region in a variety of ways including hitching rides in ship ballast water, accidental releases from aquariums, escape from water gardens and intentional introduction. Exotic species are unintentionally spread by boaters when plant fragments are tangled on boats, motors, trailers, fishing gear, and dive gear. Some species, including the Zebra Mussel, have a microscopic larval form that can travel undetected in ballast water, cooling water, live-well water and bait bucket water to new locations.

Figure 19 Salvinia molesta

Salvinia molesta, one of the world's most noxious aquatic weeds, is notorious for dominating slow moving or quiet freshwaters. Giant salvinia is native to South America. It is a small free-floating plant that grows in clusters and develops into dense, floating mats or colonies in quiet water, undisturbed by wave action. The floating leaves of giant salvinia are oblong (0.5 to 1.5 inches long) with a distinct midrib along which the leaf may fold forming a compressed chain-like appearance. Salvinia has stiff leaf hairs on the upper surface of the leaves. In giant salvinia the leaf hairs have a single stalk that divides into four branches that reconnect at the tip, giving the hair a cage-like or egg-beater appearance. Underwater the leaves are modified into small root-like structures. The entire plant is only about 1 to 2 inches in depth. Salvinias are ferns and have no flower. Giant salvinia has sporangia but are thought to reproduce only by fragmentation. Giant salvinia can double in size in 4 to 10 days under good conditions. *Salvinia molesta* demonstrates tolerance to freezing air temperatures, but cannot withstand ice formation on the water surface. A single plant has been described to cover forty square miles in three months. Giant salvinia is an aggressive invader species. Its rapid growth, vegetative reproduction and tolerance to environmental stress make it an aggressive, competitive species known to impact aquatic environments, water use and local economies.

If colonies of giant salvinia cover the surface of the water, oxygen depletion and fish kills can occur. These colonies of salvinia will also eliminate submerged plants by blocking sunlight penetration. Salvinia has no known direct food value to wildlife and is considered an exotic and highly undesirable species. Boats and other recreational watercraft transport salvinia from one water body to another. Some plants will get pushed by wind or carried by water flow to new areas. Unintentional introductions from flooded aquatic plant nurseries, ornamental ponds, and water gardens are a threat. A table showing the introduction of Salvinia into Louisiana is shown below.

Timeline of Introduction of Salvinia to Louisiana

July 1998	A handful of plants collected at Bayou Teche in Breaux Bridge are suspected to have been carried in on a boat trailer launched at the Breaux Bridge ramp. The plants were mature, sporocarp bearing and of the mat-forming stage, additional plants were not observed. Surveys and repeated visits failed to located *Salvinia molesta* in Bayou Teche and the species is not considered as having been established there
September 1998	*Salvinia molesta* first discovered on the Louisiana side of Toledo Bend Reservoir, a 186,000 acre impoundment of the Sabine River on the Texas-Louisiana border.
September 1999	Plants escape into canals from a pond at a small diked swamp near Houma [David Rosen 887 (NO)]. Despite continued herbicide efforts this infestation spread by Dec. 2001 to drainage ditches and a crawfish pond on the neighboring wet pasture
October 2000	Neighboring private ponds west of Lafayette found infested. Herbicide may have controlled by Nov. 2001.
November 2001	*Salvinia molesta* new to Cameron Parish, at marsh ponds and a canal leading to the ship channel north of Cameron. Helicopter survey found the infestation extending 6.5 miles east down the canal and within one half mile north and south of the canal, in marsh ponds.
January 2003	December's storms in southern Louisiana caused extremely high flood conditions that washed *Salvinia molesta* out of the Cameron Canal and into an extensive marsh system that could easily affect hundreds of acres.
December 2004	Giant salvinia was confirmed in the Jefferson Davis Parish after an alert landowner reported giant salvinia from his farm ponds in Fenton. Louisiana Department of Wildlife and Fisheries found two small ponds blanketed with *Salvinia molesta*, while the third pond had only a few scattered plants along the shoreline. Although the pathway of the plants is uncertain, officials started deciding among several options for attacking the infestation.

Table 5 Timeline of Introduction of Salvinia into Louisiana

6.5 Nutrients

6.5.1 Nitrates/Nitrites

Clear and Smithport Lakes' suspected causes of impairment are all based on natural conditions. The "natural" sources of nitrate are plant and animal decay and precipitation. These natural sources are ecologically important, and they are not normally at levels likely to cause pollution problems.

Nutrients are necessary for the survival and growth of aquatic plants which are the base of the food chain for all other aquatic organisms. Although a number of nutrients (such as nitrogen, phosphorus, silica, carbon, potassium, calcium, and magnesium) are needed by plants for growth and reproduction, nitrogen and phosphorus are the two of particular interest that are more commonly monitored by volunteer monitoring programs. Nitrogen and phosphorus are the nutrients that limit plant growth in most aquatic systems.

Figure 20 Smithport Dam with water in it. Clear/Smithport Lake on left; Bayou Pierre on right. Picture taken February 2, 2005

Nutrient levels in an aquatic system vary depending upon temperature, rainfall, runoff, biological activity, and the flushing of the aquatic system. Clear Lake and Smithport Lake do not have much movement and flushing of water, which may be a cause for its low dissolved oxygen concentration. Nutrient levels are generally higher in the spring and early summer and impact the aquatic system in several ways. High nutrient levels can accelerate eutrophication of a waterway. Eutrophication is characterized by abundant growth of phytoplankton (microscopic plants and algae) called algal blooms that may block sunlight from submerged aquatic vegetation. These algal blooms result in lower dissolved oxygen levels as decomposition of their organic matter consumes the dissolved oxygen.

Nutrient concentrations in aquatic systems are influenced by both natural and human sources.

Figure 21 Smithport Dam without any water. Clear/Smithport Lake on left; Bayou Pierre on right. Picture taken Nov. 5, 2008

Natural sources of nitrogen and phosphorus include decomposition of organic matter, nitrogen fixation of atmospheric nitrogen by certain bacteria and algae, and geologic formations rich in nitrogen or phosphorus. Human sources include discharges from wastewater treatment plants, storm water runoff, livestock wastes, fertilizer runoff from lawns and agricultural fields, groundwater seepage from failing septic systems, planting of nitrogen fixing plants (such as clover or beans) in agricultural fields, and atmospheric deposition (including acid rain) from the burning of fossil fuels.

Nitrates are also a by-product of septic systems. Specifically, they are a naturally occurring chemical that is left after the break down or decomposition of animal or human waste. Water quality may also be affected through ground water resources that have a high number of septic systems in a watershed. Septic systems can leach down into ground water resources or aquifers. Lakes that rely on ground water are often affected by nitrification through this process.

According to the NRCS District Conservationist, the nitrites/nitrates in this area are probably coming from decaying vegetation, such as leaf litter, pine needles, and vegetation in the lake itself. During the watershed tour, there were homes sitting on the edge of the lake that may possibly be depositing waste from their septic systems directly into the lakes. According to the Shreveport/Mansfield Office of the NRCS, a few years ago, USDA created a program that helped with the repair/replacement of septic systems in the area.

6.5.2 Phosphates

The nonpoint sources of phosphates include: natural decomposition of rocks and minerals, storm water runoff, agricultural runoff, erosion and sedimentation, atmospheric deposition, and direct input by animals/wildlife; whereas point sources may include: wastewater treatment plants and permitted industrial discharges. In general, nonpoint source pollution is typically significantly higher than the point sources of pollution. Therefore, the key to sound management is to limit the input from both point and nonpoint sources of phosphate.

Phosphorus is one of the key elements necessary for the growth of plants and animals; however, in lake ecosystems it tends to be the growth limiting nutrient and is a backbone of the Kreb's Cycle and DNA. The presence of phosphorus is often scarce in well oxygenated lake waters and importantly, the low levels of phosphorus limit the production of freshwater systems. Unlike nitrogen, phosphate is retained in the soil by a complex system of biological uptake, absorption, and mineralization. Phosphates are not toxic to people or animals unless they are present in very high levels. Digestive problems could occur from extremely high levels of phosphate. The soluble or bio-available phosphate is then used by plants and animals, and the availability of phosphorous is a key factor controlling photosynthesis. Phosphate will stimulate the growth of plankton and aquatic plants, which provide food for larger organisms, including: zooplankton, fish, humans, and other mammals. Plankton represents the base of the food chain. Initially, this increased productivity will cause an increase in the fish population and overall biological diversity of the system. But as the phosphate loading continues and there is a build-up of phosphate in the lake or surface water ecosystem, the aging process of lake or surface water ecosystem will be accelerated. The overproduction of the lake or waterbody can lead to an imbalance in the nutrient and material cycling process. Eutrophication (from the Greek - meaning "well nourished") is enhanced production of primary producers resulting in reduced stability of the ecosystem. Excessive nutrient inputs, usually nitrogen and phosphate, have been shown to be the key cause of eutrophication in waterbodies. This aging process can result in large fluctuations in the lake water quality and trophic status and in some cases periodic blooms of cyanobacteria.

In situations where eutrophication occurs, the natural cycles become overwhelmed by an excess of one or more of the following: nutrients such as nitrate, phosphate, or organic waste. The excessive inputs, usually a result of human activity and development, appear to cause an imbalance in the "production versus consumption" of living material in an ecosystem. Under aerobic conditions (presence of oxygen), the natural cycles may be more or less in balance until an excess of nitrate (nitrogen) and/or phosphate enters the system.

At this time, the water plants and algae begin to grow more rapidly than normal. As this happens there is also an excess die off of the plants and algae as sunlight is blocked at lower levels in the waterbody. Bacteria try to decompose the organic waste, consuming the oxygen, and releasing more phosphate which is known as "recycling or internal cycling". Some of the phosphate may be precipitated as iron phosphate and stored in the sediment where it can then be released if anoxic conditions develop. In anaerobic conditions (absence of oxygen), as conditions worsen as more phosphates and nitrates may be added to the water, all of the oxygen may be used up by bacteria in trying to decompose all of the waste. Different bacteria continue to carry on decomposition reactions; however the products are drastically different. The carbon is converted to methane gas instead of carbon dioxide; sulfur is converted to hydrogen sulfide gas. Some of the sulfide may be precipitated as iron sulfide. Under anaerobic conditions, the iron phosphate precipitates in the sediments and may be released from the sediments making the phosphate bioavailable. This is a key component of the growth and decay cycle. The pond, stream, or lake may gradually fill with decaying and partially decomposed plant materials to make a swamp, which is the natural aging process. The problem is that this process has been significantly accelerated. The rapid growth of aquatic vegetation and/or increase in the algal population can cause the death and decay of vegetation and aquatic life because of the decrease in dissolved oxygen levels.

6.6 Developed/Urban Areas

Urban areas/built up land only account for 4.57% of Clear and Smithport Lakes' land use; however, it is important to note that a majority of those homes are situated on the banks of the lakes. Therefore, those homes, though not many, may be depositing waste in close proximity, or into the lakes. Uncontrolled or treated runoff from urban areas and from construction activities can run off the landscape

Figure 22 Logging activities in the Clear/Smithport Watershed

into surface waters. During the November 5th site visit, logging activities were noted to be occurring in close proximity to the Lakes'. This runoff can include such pollutants as sediments, pathogens, fertilizers/nutrients, hydrocarbons, and even metals. Pavement and compacted areas, roofs, reduced tree canopy and open space increase runoff volumes that rapidly flow into our waters. This increase in volume and velocity of runoff often causes stream bank erosion, channel incision and sediment deposition in stream channels. In addition, runoff from these developed areas can increase stream temperatures that along with the increase in flow rate and pollutant loads negatively affect water quality and aquatic life.

Other common sources of urban pollution include improperly sited, designed and maintained onsite wastewater treatment (septic) systems, pet waste, lawn and garden fertilizers and pesticides, household chemicals that are improperly disposed of, automobile fluids, and vehicle emissions. A common mistake of homeowners is to spray weed killer into ditches instead of simply mowing it. It is a mistake because a lot of those ditches may lead to a body of water.

7.0 Nonpoint Source Pollution Solutions

Based on the evaluation of water quality data and supporting information characterizing the watershed, management measures were identified which will be necessary to achieve recommended pollutant reductions in the Clear Lake/Smithport Lake Watershed. Management measures are proposed to address both nutrient and sediment concerns.

The following sections will outline the management measures intended to reduce the nonpoint source problems in Clear Lake/Smithport Lake. Additionally, in most instances, a combination of best management practices is recommended in order to maximize pollutant reductions. Appendix B includes information on the effectiveness of pastureland and cropland best management practices, and pollutant reduction performances. Appendix C includes additional cost information on BMPs.

7.1 Forestry

Most streams originating in or flowing through our timberlands are sources for water supplies, recreation, and other uses. However, those same streams can be polluted by pesticides, herbicides, fertilizers, fire-retardant chemicals, organic matter and woody debris, and even by thermal pollution from increased water temperature where trees along streams have been removed. Increased temperatures influence dissolved oxygen concentration and bacterial populations in streams. Consequently, a plan should be put into place to maximize the efficiency of our forests, minimize traffic, preserve soil integrity, and protect water quality.

Figure 23 Section of Clear/Smithport Lake that has been damaged due to boats entering and exiting

The recommended Forestry Best Management Practices are listed below:

- During the site visit, the forest roads that were observed were not paved. Therefore, care should be taken to minimize the amount of soil on the road banks or roadsides that is exposed to soil erosion. To minimize problems, revegetate (using seeding or planting), or otherwise stabilize these areas as they are created. Use mixes of species and treatments developed and tailored for successful vegetation establishment for the region or area. Revegetation of areas of disturbed soil can successfully prevent sediment and pollutants associated with the sediment (such as phosphorus and nitrogen) from entering nearby surface waters. The vegetation controls soil erosion by dissipating the erosive forces of raindrops, reducing the velocity of surface runoff, stabilizing soil particles with roots, and contributing organic matter to the soil, which increases soil infiltration rates. Minnesota's Stewardship Incentives Program (SIP) estimated the costs of reestablishment of permanent vegetation to vary from $80.00/acre to $147.00/acre of disturbed area, depending on the type of vegetation used (USEPA 2008). According to the LDAF, conservation practice(322), channel bank vegetation, moderately to substantially decreases soil erosion on the streambank; slightly to moderately decreases damage to the soil due to sediment deposition; there's a moderate to substantial decrease in conveyances by sediment deposition and a moderate decrease in sediment accumulation; there's a moderate decrease in suspended sediment and turbidity in surface water; a slight to moderate decrease in harmful temperatures of surface water; and a moderate to substantial decrease in fish and wildlife habitat fragmentation. When using some form of channel stabilization(584), the research shows a moderate decrease in streambank erosion; there's a slight to moderate decrease in soil condition due to damage from sediment deposition; a slight to moderate decrease in excessive seepage; a slight decrease in conveyances by sediment deposition, sediment accumulation, excessive suspended sediment and turbidity in surface water, and harmful temperatures of surface water; and a slight to moderate decrease in fish and wildlife habitat fragmentation.

Figure 24 An unpaved road along Smithport Dam area

- Carefully plan ground and aerial application to avoid direct and indirect entry of chemicals into streams and impoundments. Leave well marked buffer zones between target area and surface water.
- Install riparian buffers. Riparian buffers are strips of grass, trees or shrubs established adjacent to streams, ditches, wetlands or other water bodies. A riparian buffer serves the following functions as it pertains to pollutants:

- Trapping/removing sediment in runoff
- Trapping/removing phosphorus, nitrogen, and other nutrients that can lead to eutrophication of aquatic ecosystems
- Trapping and removing other contaminants, such as pesticides
- Maintaining good water quality

The 2008 average cost of tree/shrub establishment according to the LDAF (including planting) would be approximately $135 an acre for hardwood and bare root seedlings; and approximately $130 an acre for pine/hardwood seedling mixture (plant costs included).

Also, according to the LDAF, riparian forest buffers (391) provide many environmental benefits, some of which include:

- moderately decrease mass movement of soil;
- moderately decrease shoreline and streambank erosion;
- slight to moderate decrease in erosion due to wind;
- moderate to substantial decrease in soil compaction;
- slight to moderate decrease in contaminants from residual pesticides;
- slight decrease in salts and other chemicals;
- slight to moderate decrease in damage from sediment deposition;
- moderate to substantial decrease in organic matter depletion;
- moderate decrease in animal waste and other organics (N,K,P);
- moderate decrease in contaminants from commercial fertilizer (N,P,K);
- moderate increase in excessive runoff, flooding, or ponding;
- slight to moderate decrease in excessive seepage and excessive subsurface water;
- substantial decrease in sediment deposition and accumulation;
- slight decrease in excessive nutrients and organics in groundwater and surface water;
- moderate to substantial decrease in excessive suspended sediment and turbidity in surface water;
- slight to moderate decrease in harmful levels of pathogens in groundwater and a moderate decrease in harmful levels of pathogens in surface water;
- slight to moderate decrease in harmful levels of pesticides in groundwater;
- moderate to substantial decrease in harmful levels of pesticides in surface water;
- moderate to substantial decrease in noxious and invasive plants.

To enhance riparian buffer effectiveness, control grazing as well as weeds and brush in grass buffer areas. Remove sediment and reseed the buffer periodically.

Additional Louisiana Forestry best management practices can be found at http://www.ldaf.state.la.us/divisions/forestry/forestmanagement/best-management-practices.asp. The Forestry Best Management Practices manual has been and will continue to be an invaluable source of information and recommendations for Louisiana (LDEQ, 2000).

7.2 Developed/Urban Areas

- Inspect 100% of newly installed septic systems. If the systems are inspected correctly, and pass, that means they are functioning correctly, and not polluting the area; therefore, there will be no loading into the bayou.
- Lawn Maintenance and Landscaping: Lawns are dynamic ecosystems consisting of plants, soil, microbes, invertebrates,

birds and small mammals. There are also humans who influence this ecosystem through mowing, watering, fertilizing and applying pesticides. Understanding and working within the natural processes that shape the lawn and its soil community can yield a durable, beautiful lawn that is easier to care for. These same ecologically sound methods can also help reduce water use, waste generation and water pollution.

- Individuals and businesses should select professional lawn care service and landscaping companies which employ trained technicians who follow practices designed to minimize the use of fertilizers and pesticides.
- Individuals should reduce the use of fertilizers and pesticides. If they must be used, follow instructions carefully and be careful using them around waterbodies.
- Use "slow release" or "natural organic" fertilizers which release nutrients to feed the lawn slowly and prevent loss through leaching and runoff. Fall fertilization builds the plant's nutrient reserves for the next season. Don't fertilize in the early spring because your grass will grow too fast.
- Set your mower blade to cut only the top third of the grass blade and leave the clippings on the ground. The clippings can supply at least 1/4 of your lawn's fertilizer needs, saving you time and money. Your lawn will be healthier, absorb more rain and filter sediments. For best results, keep the blade sharp, mow when the grass is dry and mow more often in the spring.
- Set realistic expectations for lawn appearance and accept a few weeds.
- Prune infested vegetation and use natural predators to keep pests in check. Pesticides can kill beneficial and desirable insects, such as ladybugs, as well as pests.
- Compost yard and kitchen waste and use it to boost your garden's health as an alternative to chemical fertilizers.
- Grow native plants in your garden — they require less water, fertilizers and pesticides.
- Plant trees, shrubs and other plants to slow water running off your property. This helps to prevent soil erosion and to increase water absorption.

- Educational Outreach: Should promote clear identification and understanding of the problem and the solutions; identify responsible parties and efforts to date; promote community ownership of the problem and its solutions; change behaviors; and integrate public feedback into program implementation.

7.3 Nutrients

- Nitrate loading from domestic septic systems is not currently being controlled. Loading from septic systems could be controlled, though not easily, through planning and establishment of zoning that limits where septic systems are located, how they are constructed, and the number of onsite systems that are located in a given area.
- Pet wastes can contribute significant amounts of bacteria and organic matter to storm water runoff. This problem is particularly serious because the wastes are often deposited in street gutters where runoff carries the waste directly

into streams. Parasites and bacteria found in pet wastes can transmit disease and pose human health risks to those who come in contact with the contaminated water, including children playing along side waterways. In short, pet owners should collect and dispose of their pet's wastes in a responsible manner.

- Animal wastes can be controlled through bylaws requiring collection and removal of the waste from curbsides, yards, parks, roadways and other areas where the waste can be washed directly into receiving waters.
- Pet owners should carry plastic, leak proof bags while on walks to clean up wastes. Bags should be sealed and deposited in trash cans. At home, small amounts of pet wastes can be flushed down the toilet (if it doesn't go to a septic tank) or buried in holes at least 20 cm deep, away from any waterway, well, or vegetable garden. However, DO NOT ADD IT TO YOUR COMPOST PILE.

Figure 25 Weevil, a biocontrol agent for Salvinia molesta

7.4 Non-Native Aquatic Plants

7.4.1 The salvinia weevil, *Cyrtobagous salviniae*

The weevil is a proven biocontrol agent for *Salvinia molesta*. This tiny insect causes immense damage to plants by tunneling through rhizomes and feeding on terminal buds. Such feeding acts to greatly reduce large infestations of *S. molesta* and to maintain low plant population levels .The salvinia weevil's natural range is southeastern Brazil, Bolivia, Paraguay and northern Argentina. The weevils, experimentally released in October of 2001 by USDA/ARS in Texas and Louisiana, were imported under permit from Australia, where they are reared and used for biological control of *Salvinia molesta*.

7.4.1.1 Current Work

The Louisiana State University Agriculture Center (LSU AgCenter) has had a two pronged approach to the problem. They are continuing to evaluate herbicides to determine their effectiveness on giant salvinia. This includes work at the Jones/Idlewild Research Station in Clinton and an off-station site at Gheens. To date they have screened nearly 20 different herbicides as well as about a dozen trials on surfactant/rate/timing studies. This information has been forwarded to Wildlife and Fisheries for their spray program. LSU Ag has also worked with a couple of contractors for the Corps who are spraying south of Hwy 90. The second prong of attack is with salvinia weevils. This work is in conjunction with an employee in the Entomology Department. They have established a weevil nursery on a private ranch at Gheens. This work is under a contract with Wildlife and Fisheries. They are producing large numbers of weevils for release by Wildlife and Fisheries around the state. This is the Brazilian strain of the weevil that came from Lewisville, TX so they are hoping that it is cold tolerant. To date, releases have been made at Turkey Creek, Toledo Bend, Clear Lake, Loggy Bayou, Black

Lake, Caddo Lake, Lake Bisteneau, Smithport Lake, Bayou DesAllemand, Lake Salvadore, the Atchafalaya Basin, numerous sites at Gheens and a release for Saline Lake is planned in the near future. These are industrial size releases where they are harvesting large volumes of infested salvinia. The jury is still out on whether this will work. They have seen some establishment of the weevils in south LA and will continue to monitor the populations in north LA. Though there have been huge claims of success around the world, Louisiana is further from the equator than those success stories and the salvinia can withstand colder temps than the weevil, LSU Ag employees are very hopeful that these releases take hold and help the problem. LSU Ag has spent approximately $50,000 a year out of their budget on the weevils.

7.4.2 Drawdown

Drawdown is limited to lakes with adequate water control structures and a reliable source of water for refilling the lake. Drawdowns are usually conducted during winter to expose plants to drying and freezing. The advantages include low cost as well as oxidation and consolidation of sediment. Drawdowns also increase options for chemical controls because some chemicals are more effective when applied to dry water bottoms. One disadvantage of drawdowns is that they may reduce desirable species and allow tolerant species to spread further. There may also be some loss of recreational benefits such as duck hunting and spring fishing. Another drawback is that according to the NRCS, salvinia does not respond to drawdowns; however, it may help with the water hyacinth, alligator weed, and other submerged aquatic vegetation.

7.4.2.1 Current Work

Clear/Smithport Lake has historically had problems with heavy infestations of water hyacinth, alligator weed and submerged aquatic vegetation. Over the years these plants, along with leaf litter from the cypress canopy, have built up a large amount of organic matter on the lakebed. This organic matter has led to the loss of spawning habitat for desirable sport fish such as largemouth bass, crappie and bream.

Following studies into the habitat problems and the possible solutions, LDWF Inland Fisheries biologists have developed a plan to improve the quality of Clear/Smithport Lake through a series of up to three consecutive drawdowns. The plan is to improve the bottom substrate by allowing the build-up of organic matter to dry and decompose. The drawdowns should also reduce the submerged vegetation. The invasive aquatic plant, giant salvinia, has become a major problem in the lake and the drawdown will also help control the salvinia that is stranded and dries and desiccates during the drawdown.

Figure 26 Dead Salvinia on the boat ramp; the pile was kicked and beneath the dead Salvinia, were a few live plants (notice the green)

LDWF will continue its efforts to control noxious floating and emergent aquatic vegetation through herbicide applications in conjunction with the drawdown. The drawdown will run through Jan. 30, 2009, at which time the gates will close and the lake will be allowed to refill with water. It is expected that the lake will drain at a rate of 4-to-6 inches per day. The lake will be drained as completely as possible to allow for

Figure 27 Close up view of Salvinia molesta. Taken from Florida's Department of Environmental Protection website

maximum benefits from the drawdown. The effects of the drawdown on the fisheries habitat, fish population and aquatic vegetation coverage will be evaluated to determine if an additional drawdown is needed.

7.4.3 Herbicides

Herbicides are chemicals that kill plants or inhibit their normal growth. Their means of doing this are varied and are as numerous as the processes essential to plant life. The choice of the best specific combination varies with agronomic, ecological and economic factors. Herbicides kill plants through either contact or systemic action. Contact herbicides are most effective against annual weeds and kill only the plant parts on which the chemical is deposited. Systemic herbicides are absorbed either by roots or foliar parts of a plant and are then translocated within the plant system to tissues that may be remote from the point of application. Although systemic herbicides may be effective against both annual and perennial weeds, they are particularly advantageous against established perennial weeds.

7.4.3.1 Current Work

The Louisiana Department of Wildlife and Fisheries has helped clear 750 acres of two nuisance aquatic plants on Turkey Creek in Franklin Parish by using a new chemical called Galleon. The eradication of giant salvinia and water hyacinth on the popular fishing lake started in the summer of 2008 and it's continuing today with a spraying crew on the lake four days a week searching for patches that were missed. A major stumbling block to the use of the new chemical, Galleon, is its cost per gallon: $1,750.The chemical has been a success in Turkey Creek Lake, but it is not a fix-all technique in all waterbodies because the chemical does not work in moving water or where water is constantly being replaced. A comprehensive water depth and plant

Figure 28 Giant Salvinia molesta. Picture taken from Colorado's Noxious Weed list.

abundance survey of the lake was done, and the herbicide was then applied in the infested areas of the lake. This pesticide has an EPA-approved aquatic label with no restrictions on the use of treated water for recreational purposes, including swimming and fishing. Galleon is a water dispersible herbicide that isn't sprayed on the plant, but it is injected into the water, and is then absorbed by the roots of floating plants. This particular method of treatment is especially effective when the nuisance vegetation is inaccessible by conventional spray pesticide application methods. The plants in Turkey Creek were so thick and in such large mats that access by the boat sprayers was almost impossible; the sprayers had to spray an edge and wait for that section to die so that they could access the next available edge. Salvinia and water hyacinth grow rapidly; therefore, using conventional spray methods was not working. By using the water dispersible chemical, wherever there was water, the herbicide could disperse into that area and infect the plant. After two to three months, the herbicide took effect on the majority of the giant salvinia and water hyacinth, which eventually turned brown and sank. Not all floating plants were killed in the initial treatment because of 20 inches of rainfall from Hurricane Gustav, which dispersed the herbicide in the system. Because of the success of the Galleon application, the spray crew is now able to use a cheaper, foliar chemical, Diquat, to spray patches of the aquatic vegetation. The department used 75 gallons in its treatment. According to LDWF, one gallon of Galleon covers 47-acre feet of water. It is estimated that the herbicide treatment killed approximately 95 percent of the giant salvinia and water hyacinth, but continuing surveillance is necessary because giant salvinia doubles its size every three days and can choke off areas of the lake within a few weeks. LDWF employees are carrying out continuous spray efforts at this time.

7.5 Grassland/Pasture

- Prescribed grazing manages the controlled harvest of vegetation with grazing animals to improve or maintain the desired species composition and vigor of plant communities, which improves surface and subsurface water quality and quantity. Controlled harvest of vegetation through grazing rotation allows for establishment of a dense vegetative stand, which can reduce soil erosion and retain soil nutrients. Further, native plant species could be planted periodically to maintain a dense vegetative cover and improve the hydrologic condition of the farmland.
- Riparian Areas are a fringe of land that occurs along the stream or water courses. If the riparian buffer is not adequately established and farming activities occur to the edge of the stream, the banks become unstable resulting in significant sloughing and channel scour. Establishing and maintaining a good riparian buffer, stabilizing channels and protecting shorelines using live stakes, riprap and gabions could considerably reduce the channel erosion.
- Watering Facilities are devices (tank, trough, or other watertight container) that provide livestock with alternative access to water and protect streams, ponds, and water supplies from contamination. Be sure to place the containers on top of a concrete pad to prevent further erosion problems from occurring.
- Filter Strips are vegetated areas that are situated between surface water bodies (i.e. streams and lakes) and cropland, grazing land, forestland, or disturbed land. They are generally in locations when runoff water leaves a field with the intention that sediment, organic material, nutrients, and chemicals can be filtered from the runoff water. Filter strips are also known as vegetative filter or buffer strips. Strips slow runoff water leaving a field so that larger particles, including soil and organic material can settle out. Due to entrapment of sediment and the establishment of vegetation, nutrients can be absorbed into the sediment that is deposited and remains on the field, enabling plant uptake.
- Planting pastures with native vegetation that will allow for reduction and absorption of nutrients. Range and pasture planting require the establishment of adapted perennial vegetation (preferably native). Grass, forbs, legumes, shrubs and trees work to restore a plant community similar to historically natural conditions yet sensitive to the nutritional needs of livestock and native species.
- Fencing is a constructed barrier that will prevent access to drainages and streambeds to animals and humans. This will permit the existence of vegetation and other impediments to erosion, sedimentation, and nutrient loadings.

To focus management plan development and implementation, management measures addressing sediment and nutrient issues will be encouraged and given top priority. In addition, preference will be given to operations closest to streams and drainage areas with the greatest potential to contribute nonpoint source pollutants to Clear/Smithport Lake.

7.6 Hydromodification

- Riparian vegetation is very important and should be incorporated into hydromodification projects along the lakes for the following reasons:
  - Flood control: during high stream flows, riparian vegetation slows and dissipates

floodwaters. This prevents erosion that damages fish spawning areas and aquatic insect habitats.

- Bank stabilization and water quality protection**:** the roots of riparian trees and shrubs help hold stream banks in place, preventing erosion. It also traps sediment and pollutants, helping keep the water clean.
- Wildlife habitat: riparian vegetation provides food, nesting, and hiding places for some animals.

- Develop tactics to enforce stream bank protection, such as:
  - Protection of existing vegetation along stream banks
    - Preserving onsite vegetation retains soil and limits runoff of water, sediment, and pollutants. The destruction of existing onsite vegetation can be minimized by initially surveying the site to plan access routes. Reducing the disturbance of vegetation also reduces the need for revegetation after construction is completed, including the required fertilization, replanting, and grading associated with revegetation. Additionally, as much natural vegetation as possible should be left next to the waterbody where construction is occurring. This vegetation provides a buffer to reduce the NPS pollution effects of runoff originating from areas associated with the construction activities.
  - Installation of stone riprap revetment, erosion control fabrics and mats, burlap sacks, cellular concrete blocks, and bulkheads.
    - Riprap is a layer of appropriately sized stones designed to protect and stabilize areas subject to erosion, slopes subject to seepage, or areas with poor soil structure. The approximate cost to implement this practice, including purchase, hauling, and placement, is approximately $40 a ton(NRCS)
    - Erosion Control Blankets are turf reinforcement mats (TRMs) that combine vegetative growth and synthetic materials to form a high-strength mat that helps prevent soil erosion in drainage areas and on steep slopes; labor to install this material is $4.00 per sq yd; permanent Erosion Control Matting costs approximately $2.00 per sq yd; temporary Erosion Control Matting costs approximately, $0.70 per sq yd (NRCS).

Figure 29 Erosion Control

The TMDL for Clear/Smithport Lake states that with 100% removal of manmade sources, the minimum DO was 3.36(no load scenario); in order to meet the standard for the summer months, a 100% reduction of man-made and 40% reduction of background loading is necessary; for the winter months, 100% reduction from all man-made nonpoint sources and a 40% reduction of background loading is necessary. In addition, it indicated that the existing point sources located on this waterbody, except for the Mansfield STP, were small and it is unlikely that they have an impact on the targeted waterbody due to the small load and/or the distance from the waterbody. Accordingly, BMPs need to be implemented in and around Clear/Smithport Lake to help in the reduction of pollution from manmade nonpoint sources.

7.7 Outreach and Education

To engage stakeholders and support implementation of this watershed plan, a number of outreach strategies can be used to attract and inform participants. Ongoing outreach and education efforts will maintain public involvement in the process and increase awareness of the plan and its goals throughout the watershed. Specific resources and activities that can be employed in this effort include the following:

- Fact Sheets: these sheets can feature information on selected best management practices and provide general information regarding the health of the watershed.
- Outreach and Education Work Group: The Outreach and Education work group may have the following tasks: 1) increase public awareness about water quality issues and planning and implementation efforts in the watershed, and 2) motivate individual actions to improve water quality in the Clear Lake and Smithport Lake watershed. Key audiences that can be identified by the work group include rural and urban residents including youth, homebuilders and developers, agricultural producers, elected officials, business and community leaders. To achieve these goals, the work group can develop a strategy that includes both broad-based programs directed at the general public and targeted programs intended to reach specific audiences of interest within the watershed.
- Watershed Protection Brochure: a brochure outlining Clear Lake and Smithport Lake's watershed water quality issues can be made available for distribution to the public. The publication can highlight water quality concerns, best management practices, and provide contact information for the Louisiana Department of Environmental Quality.
- Outreach at Local Events: to inform the community on what nonpoint source pollution is and how they can help reduce their contribution to it is essential. Booths can be set up at livestock expositions, youth activities, schools, libraries, and local fairs.

8.0 Making the Implementation Plan Work

Financial and technical assistance from federal, state, and local individuals is required if the nonpoint source pollution load in Clear Lake and Smithport Lake is to be reduced. The local community surrounding Clear Lake and Smithport Lake should realize that their involvement and commitment, or lack thereof, in the programs and/or recommendations will make the difference in whether the water quality of their Lakes improves or continues to disintegrate. The citizens of the area are integral pieces of the puzzle when it comes to implementing the Best Management Practices. It is anticipated that acceptance and participation among local communities will be

Figure 30 Southeast Portion of Smithport Lake; Picture taken February 2, 2005

enhanced, if we develop strategies for the reduction of pollutants by consulting with and advising stakeholders.

8.1 Actions Being Implemented by the LDEQ

LDEQ is presently the designated lead agency to implement the Louisiana State Nonpoint Source Program. LDEQ Nonpoint Source Program works in cooperation with private, profit and nonprofit organizations that are authentic legal entities, or governmental jurisdictions including: cities, counties, tribal entities, federal agencies, or agencies of the state on approximately 40 nonpoint source projects that are active throughout the state.

8.2 Public Partnerships

Contact was made with the Desoto SWCD, Mansfield office. A guided tour of Clear Lake/Smithport Lake Watershed was given to LDEQ by a member of the SWCD on November 5, 2008. In addition to ideas relating to what needs to be done to reduce the nonpoint source pollution, notes and pictures were taken concerning the condition of the area.

Contact was also made with an employee with the Louisiana State University Agriculture Center to obtain information on the weevils and salvinia.

The LDEQ has also entered into a cooperative agreement with the Twin Valley RC&D to serve as the watershed coordinator and to lead discussions with stakeholders in the Clear Lake/Smithport Lake watershed.

Open discussion among stakeholders and project technical advisory groups will be encouraged. Project organizers may promote a template in which the opinions and concerns of stakeholders would weigh heavily into the final decisions regarding nutrient reduction goals and the selection of best management practices to achieve them. Stakeholders representing the various constituencies of the Clear Lake/Smithport Watershed will be able to advise project leaders on the feasibility and acceptance of various aspects of the Watershed Protection Plan.

8.3 Work Groups

Project leadership may determine that an efficient use of stakeholder time and effort may be to subdivide the group into separate work groups to focus on the individual issues and best management practices targeted for urban, rural, and educational areas of concern. Having rosters for each work group may ensure adequate representation of stakeholder interests.

8.4 Actions Being Implemented by Other Agencies

Crucial to the success of the Clear Lake/Smithport Lake Partnership will be the involvement of local, state and Federal Agencies. Such groups will be able to provide advice, technical support, and financial backing of the project. Agency officials will work collaboratively with stakeholders by attending meetings and offering guidance through the process of best management practice selection.

- **Natural Resource Conservation Service**

The NRCS has been actively involved in both the development and implementation of action items related to agricultural issues. This working relationship will continue as the cooperating agencies that serve on Implementation Teams work on the Action Items that were identified within the Comprehensive Conservation and Management Plan as agricultural issues.

Red River Valley Association (RRVA):

The Red River Valley Association is a nonprofit, member supported organization dedicated to the development of the land water resources of the Red River Basin. With lobbying as its primary function its strength is from the voice of its members which are chiefly from the Red River Valley states of Texas, Oklahoma, Arkansas, and Louisiana. Only through the RRVA's lobbying efforts has milestone projects such as navigation, chloride control, levee and bank stabilization, and many other worthwhile enterprises along the Red River became a reality. Some of the objectives of the RRVA include: 1) Enhancing the drainage systems and control the effects of flooding, as well as agricultural related projects; 2) Enhancing water quality through chloride control; and 3) Aiding in environmental enhancement efforts such as reforestation, wetland preservation, and wildlife aquatic refuge construction. The RRVA is eager to work with local, state, and federal entities in securing funds to implement projects that will correct resource problems within the valley.

2008 Farm Bill

Provides funding to various conservation programs for each state by way of the NRCS and local Soil and Water Conservation Districts (SWCD). The following includes a brief summary of the programs available through the local SWCD under the oversight of USDA and NRCS. The new provisions build on the conservation gains made by farmers and ranchers through the 1985, 1996 and 2002 Farm Bills. They simplify existing programs and create new programs to address high priority environmental goals. The descriptions of the programs are general and are subject to change.

- **Agricultural Management Assistance (AMA):** provides payments to agricultural producers to voluntarily address issues such as water management, water quality, and erosion control by incorporating conservation practices into their farming operations. Producers may construct or improve water management structures or irrigation structures; plant trees for windbreaks or to improve water quality; and mitigate risk through production diversification or resource conservation practices, including soil erosion control, integrated pest management, or transition to organic farming. The 2008 Farm Bill amended Section 524(b)(1) of the Federal Crop Insurance Act to add Hawaii as an eligible AMA State. Funding is made available through the Commodity Credit Corporation (CCC) for each fiscal year from 2008 through 2012 in the amount of $15 million.

- **The Cooperative Conservation Partnership Initiative (CCPI):** provides targeted assistance to producers for enhancing conservation outcomes on agricultural and nonindustrial private forest land. Areas of CCPI assistance are selected competitively through applications of eligible partners. Eligible partners include State, local and Tribal governments, producer associations and cooperatives, institutions of higher education, and nongovernmental organizations.

- **The Conservation of Private Grazing Land (CPGL) Program:** is a voluntary program that helps owners and managers of private grazing land address natural resource concerns while enhancing the economic and social stability of grazing land enterprises and the rural communities that depend on them. The Natural Resources Conservation Service (NRCS) manages this program. This program does not include financial assistance. However, financial assistance may be provided through other Federal, State, and local programs that address grazing land resource concerns.

- **The Conservation Stewardship Program (CSP):** is a voluntary conservation program that encourages producers to address resource concerns in a comprehensive manner by: undertaking additional conservation activities; and improving, maintaining, and managing existing conservation activities. CSP is available on Tribal and private agricultural lands in all 50 States and the Caribbean and Pacific Islands Areas. The program provides equitable access to all producers, regardless of operation size, crops produced, or geographic location. CSP payments to an individual or legal entity may not exceed $200,000 for all contracts entered into during any 5-year period.

- **Environmental Quality Incentive Program (EQIP):** is a voluntary program that provides financial and technical assistance to farmers and ranchers who face threats to soil, water, air, and related natural resources on their land. Through EQIP, the Natural Resources Conservation Service (NRCS) provides financial incentives to producers to promote agricultural production and environmental quality as compatible goals, optimize environmental benefits, and help farmers and ranchers meet Federal, State, Tribal, and local environmental regulations. Funding for each fiscal year is authorized as follows: $1.2 billion for 2008; $1.337 billion for 2009; $1.45 billion for 2010; $1.588 billion for 2011; and $1.75 billion for 2012.

- **Conservation Innovation Grants (CIG):** stimulate the development and adoption of innovative conservation approaches and technologies while leveraging Federal investment in environmental enhancement and protection in conjunction with agricultural production. Under this competitive grant program, Environmental Quality Incentives Program (EQIP) funds are awarded to non-Federal or Tribal governments, non-governmental organizations, or individuals. Through CIG, the Natural Resources Conservation Service (NRCS) works with other public and private entities to accelerate technology transfer and the adoption of promising approaches to address some of the Nation's most pressing natural resource concerns. CIG benefits agricultural producers by providing more options for environmental enhancement and compliance with Federal, State, and local regulations.

- **The Farm and Ranch Lands Protection Program (FRPP):** is a voluntary program that helps farmers and ranchers keep their land in agriculture. The program provides matching funds to State, Tribal, or local governments and non-governmental organizations with existing farm and ranch land protection programs to purchase conservation easements. From 1996 through 2007, FRPP has enrolled over 533,000 acres in cooperation with more than 400 entities in 49 States.

Figure 31 A stretch of Clear/Smithport Lake. The "grassy area" is actually Salvinia

- **The Grassland Reserve Program (GRP):** is a voluntary program for landowners and operators to protect, restore, and enhance grassland, including rangeland, pastureland, shrubland, and certain other lands. The program emphasizes support for working grazing operations; enhancement of plant and animal biodiversity; and protection of grassland and land containing shrubs and forbs under threat of conversion. In the last 5 years, GRP has closed on over 250 easements covering more than 115,000 acres in 38 states.

- **The Healthy Forests Reserve Program (HFRP):** is a voluntary program established for the purpose of restoring and enhancing forest ecosystems to: 1) promote the recovery of threatened and endangered species, 2) improve biodiversity; and, 3) enhance carbon sequestration.Program implementation has been delegated by the Secretary of Agriculture to the Natural Resources Conservation Service. Not more than 40 percent of program funding shall be used for cost-share agreements, and not more than 60 percent may be used for easements. The Bill provides $9.75 million for each of fiscal years 2009 through 2012; funds made available for the program shall remain available until expended.

- **Small Watershed Rehabilitation Program:** Local communities, with USDA Natural Resources Conservation Service (NRCS) assistance, have constructed over 11,000 dams in 47 states since 1948. Many of these dams are nearing the end of their 50-year design life. Rehabilitation of these dams is needed to address critical public health and safety issues in these communities. This program would provide essential funding for the rehabilitation of aging small watershed impoundments and dams that have been constructed over the past 50 years.

- **Socially Disadvantaged Ranchers Beginning Farmers:** The Food, Conservation, and Energy Act of 2008 (2008 Farm Bill) continues to address the unique circumstances and concerns of socially disadvantaged farmers and ranchers, as well as beginning and limited resource farmers and ranchers. It provides for voluntary participation, offers incentives, and focuses on equity in accessing U.S. Department of Agriculture (USDA) programs and services. Enhancements include streamlined delivery of technical and financial assistance; improved programs and services; and flexibility in decision making (with most decisions made at the Tribal, State, or local level). The 2008 Farm Bill also authorizes the Secretary of Agriculture to provide up to 90 percent of the costs associated with planning and implementing conservation measures for socially disadvantaged and beginning farmers or ranchers. In addition, up to 30 percent of such payments may be provided in advance for purchasing materials or contracting. Title II of the 2008 Farm Bill defines a socially disadvantaged farmer or rancher as "a member of a socially disadvantaged group whose members have been subjected to racial or ethnic prejudice because of their identity as members of the group without regard to their individual qualities." This is a change from the definition used by USDA under the Consolidated Farm and Rural Development Act, which also includes gender in the definition.

- **The Wetlands Reserve Program (WRP):** is a voluntary program that provides technical and financial assistance to private landowners and Tribes to restore, protect, and enhance wetlands in exchange for retiring eligible land from agriculture. Over 1.9 million acres are currently enrolled in WRP. Wetlands provide habitat for fish and wildlife, including threatened and endangered species; improve water quality by filtering sediments and chemicals; reduce flooding; recharge groundwater; protect biological diversity; and provide opportunities for educational, scientific, and limited recreational activities. The program offers three enrollment options: 1) Permanent Easement is a conservation easement in perpetuity. USDA pays 100 percent of the easement value and up to 100 percent of the restoration costs. 2)30-Year Easement is an easement that expires after 30 years. USDA pays up to 75 percent of the easement value and up to 75 percent of the restoration costs. For both permanent and 30-year easements, USDA pays all costs associated with recording the easement in the local land records office, including recording fees, charges for abstracts, survey and appraisal fees, and title insurance. 3) Restoration Cost-Share Agreement is an agreement to restore or enhance the wetland functions and values without placing an easement on the enrolled acres. USDA pays up to 75 percent of the restoration costs.

- **The Wildlife Habitat Incentives Program (WHIP)**: is a voluntary program for private landowners to develop and improve high quality habitat that supports wildlife populations of National, State, Tribal, and local significance. Through WHIP, the USDA's Natural Resources Conservation Service (NRCS) provides technical and financial assistance. WHIP agreements generally last from 5 to 10 years. WHIP payments made, either directly or indirectly, to a person or legal entity may not exceed $50,000 per year. Funding for WHIP is authorized at $85,000,000 per fiscal year through 2012.

For more information and updates about the 2008 NRCS Farm Bill Conservation Programs please visit http://www.nrcs.usda.gov/programs/farmbill/2008/ataglance.html

Louisiana Department of Agriculture and Forestry

LDAF has worked on development of action items that were contained in the Comprehensive Management Plan. Their soil and water conservation districts are the primary link with the farmers and landowners that can implement best management practices on their lands. As the Action Items contained with the CCMP are addressed, these districts will continue to play a major role in their implementation.

LSU Agricultural Center

LSU has worked closely with the state's NPS Management Program to evaluate best management practices for sugarcane. These practices have included conservation tillage, pesticide and nutrient management practices and the affect that new sugarcane harvesting methods have on pollutant transport from the fields. The sugarcane industry is constantly changing to meet the demands of a competitive market, so environmental practices need to keep pace with these changes and recommend the most innovative practices for the farmer. LSU has developed The Master Farmer Program, which is used to encourage on-the-ground BMP implementation with a focus on environmental stewardship. The LSU AgCenter is promoting this program to help farmers address environmental stewardship through voluntary, effective and economically achievable BMPs. The LSU AgCenter will tailor its Master Farmer Program to meet the needs of the producers in the watershed area. The program will be implemented through a multi-agency/organization partnership including the Louisiana Farm Bureau (LFBF), the Natural Resources Conservation Service (NRCS), the Louisiana Cooperative Extension Service (LCES), USDA-Agriculture Research Service (ARS), LDEQ and agricultural producers.

- **The Master Farmer Program** has three components: environmental stewardship, agricultural production and farm management. The environmental stewardship component has three phases. Phase one focuses on environmental education and implementation of crop-specific BMPs. Phase two of the environmental component includes in-the-field viewing of implemented BMPs on Model Farms. Phase three involves the development and implementation of farm-specific and comprehensive conservation plans by the participants. A member must participate in all three phases in order to gain program status and receive the distinction of being considered a master farmer.

Louisiana Cooperative Extension Service

LCES plays a very important role in the educational component of the NPS Management Program. They provide the farmers, local citizens, and science teachers and children with information on water quality, wetlands, habitat protection and a host of other environmental issues. Summer camps offer high school students the opportunity to learn about coastal environments, marshes, and estuaries. Marsh Maneuvers has been a very popular learning experience for students to actually spend a week in the marsh, learning about every aspect of its unique ecology. LCES has hosted and participated in workshops for science teachers on water quality, nonpoint source pollution, watershed management and wetland protection. They are the backbone of the state's educational system for adults and children on agriculture and environmental issues, and it is anticipated that they will continue to be a major partner in this important area.

Department of Health and Hospitals

The DHH has worked on nonpoint source problems associated with home sewage systems across the Red River Basin. In many areas, they have inventoried these systems and determined where maintenance problems exist or new systems need to be installed. DHH will continue to play a major role in addressing pollution that is associated with home sewage systems.

Local Parish and Municipal Governments

Local governments play such an important role in both the educational and watershed management portions of the NPS Management Program. They understand the local problems and infrastructure that is the mechanism for program implementation. They advise and guide LDEQ on how their action items can be achieved and how programmatic goals and objectives can be attained. Without their support, the program simply will not work. They understand the history of the local problems and the reasons why some solutions will work and others will fail. They have responsibilities to the people who live within the basin and need to be informed and involved in any decisions that may affect the people, economy or the resources in their area. LDEQ has worked to foster good working relationships with the local decision-makers and will continue to rely on their local expertise for future program implementation.

Local Environmental Community

They have highlighted the environmental problems that exist with saltwater intrusion and wetland loss, nutrients and pesticides from agricultural crops, and pressured both industry and government to reduce pollution from both the point and the nonpoint sources that exist across the basin. They play an important role in raising the awareness of the public about the environmental problems that exist and working to ensure that everyone continues to work to reduce these problems. LDEQ will continue to work with them as implementation strategies and TMDLs are implemented throughout the basin.

Local Civic Organizations

The local civic and service organizations are comprised of key leaders within the community. These people care about their community and want to work on programs that improve the environment and their local economy. They are the farmers, the homeowners, and the city and parish leaders that need to be involved in programs that educate the people about their water quality issues. They will be included in the educational outreach programs planned for TMDLs and watershed management and are viewed as local decision-makers in how these programs are implemented.

Police Juries:

Louisiana is unique in the nation in that it has parishes that are governed in most cases by police juries. The jury system provides government close to the people. The jury performs the legislative functions of enacting ordinances, establishing programs and setting policy. It is also an administrative body in that it is involved in preparing the budget, hiring and firing personnel, spending funds, negotiating contracts and in general, directing the activities under its supervision. The Police Jury of Natchitoches Parish, Red River, Sabine, De Soto, and the Caddo Parish Commission are five local governing bodies.

Local Universities and Schools

Universities and schools have such an opportunity to become involved in water quality, habitat protection and wetland issues that exist across the Red River Basin. Many of them have and already conduct their own water quality testing programs and have become involved in environmental education. As LDEQ works on watershed implementation, there will be opportunity for their involvement in many aspects of the programs. Surveys of home sewage systems, habitat assessment along bayous and streams, participation in demonstration projects and educational programs are all examples of activities that local schools and university students and teachers can become involved in. In some parts of the state, students have restored urban streams and worked with the Corp of Engineers to protect wetlands. They have innovative ideas and enjoy working on local issues where short-term progress can be seen.

8.5 Implementation and Maintenance of BMPs

Locating funding for the implementation and maintenance of best management practices are key elements in a successful Implementation Plan. There are a number of Federal and State funding sources that exist for BMP implementation, riparian zones, and land conservation.

8.5.1 Cost Share

The LDEQ Nonpoint Source Program provides USEPA §319(h) funding to assist in the implementation of BMPs seeking to address water quality problems in areas listed on the §303(d) list. USEPA §319(h) base funds are to be used to implement programs and projects designed to reduce nonpoint source pollution. 319(h) funds are available to all private, for profit and nonprofit organizations that are authenticated legal entities, or governmental jurisdictions including: cities, counties, tribal entities, federal agencies, or agencies of the state. Proposals are submitted by applicants through a Request for Proposal (RFP) process and require a non-federal match of 40% of the total project cost consisting of funds and/or in-kind services. The Louisiana Department of Agriculture and Forestry (LDAF) receives the incremental funds of the §319(h) grant monies. The LDAF helps to address agricultural activities that can result in the discharge of these pollutants into receiving water bodies. The LDAF works with the USDA Natural Resources Conservation Service and local SWCDs to coordinate the planning and voluntary implementation of agricultural BMPs on farms in priority watersheds to reduce the amount of nonpoint source pollutants entering water bodies.These BMPs comprise various structures and methods of operation whereby sediment, pesticides, nutrients and organic matter are stabilized or beneficially utilized on the landscape with lessened susceptibility of runoff. This program is closely coordinated with LDEQ's water quality protection efforts. Further information on funding from the Clean Water Act §319 (h) can be found on the LDEQ web site at: www.deq.state.la.us.

8.5.2 Other Federal and State Funding

The United States Department of Agriculture (USDA) offers landowners financial, technical, and educational assistance to implement conservation practices on privately owned land with the goal of reducing soil erosion, improve water quality, and to enhance crop land, forest land, wetlands, grazing lands and wildlife habitat. One of the programs sponsored by the USDA is the Conservation Reserve Program (CRP). It is designed to encourage farmers to convert highly erosive cropland to vegetative cover, such as native grasses, wildlife plantings, trees, filter strips, or riparian buffers. Farmers receive annual rental payment for the term of the multi-year contract. An additional program, The Conservation Reserve Enhancement Program (CREP), combines the resources of the CRP program with that of the State government. This program focuses on NPS pollution, water and habitat restoration. The Environmental Quality Incentives Program (EQUIP) is another source of funding available to the farmers for conservation practices. These are only a few, of many, State and Federal funding sources available to agricultural landowners that will help with the cost of reducing NPS run off from their fields.

9.0 Timeline for Implementation

In accordance with Section 106 of the federal Clean Water Act and under the authority of the Louisiana Environmental Quality Act, the LDEQ has established a comprehensive program for monitoring the quality of the state's surface waters. The LDEQ Surveillance Section collects surface water samples at various locations, utilizing appropriate sampling methods and procedures for ensuring the quality of the data collected. The objectives of the surface water monitoring program are to determine the quality of the state's surface waters, to develop a long-term database for water quality trend analysis, and to monitor the effectiveness of pollution controls. The data obtained through the surface water monitoring program is used to develop the state's biennial 305(b) report (*Water Quality Inventory*) and the 303(d) list of impaired waters. This information is also utilized in establishing priorities for the LDEQ nonpoint source program.

According to The NPS Management Plan, in 2002, Water Quality Data to Develop the Total Maximum Daily Loads was collected for the Red River Basin. From 2003-2005, the Total Maximum Daily Load for the Watershed was developed. From 2006-2008, nonpoint watershed restoration action strategies should be developed to reduce NPS pollutants in the Red River. From 2009-2012, nonpoint watershed restoration action strategies will be carried out based on this watershed plan; the watershed plan should be updated where needed. From 2014 to 2015, the development and implementation of additional corrective actions necessary to restore designated uses to the water body will be done. Throughout the process, tracking the successes and/or failures of each best management practice as well as the status of restoring the Lakes' designated uses is essential. LDEQ will work with other agencies such as local Soil Conservation Districts to implement best management practices in the watershed through the 319 programs. LDEQ will also continue to monitor the waters of Clear Lake and Smithport Lake to determine whether standards are being attained. If no improvement in water quality is witnessed, LDEQ will revise the Implementation Plan to include additional corrective actions to bring the waterway into compliance. Additional BMPs and or other options will be employed, if necessary, until water quality standards in Clear Lake and Smithport Lake are achieved and have its designated uses restored.

9.1 Tracking and Evaluation

As stated in the Louisiana Nonpoint Management Plan, program tracking and evaluation will be done at several levels to determine if the watershed approach is an effective method to reduce nonpoint source pollution and improve water quality. The steps for tracking and evaluation are as follows:

1. Tracking of actions outlined with the Watershed Restoration Action Strategy (short-term)
2. Tracking of BMPs implemented as a result of Section 319, EQIP, or other sources of cost-share ant technical assistance within the watershed (short term)
3. Tracking the progress in reducing nonpoint source pollutants such as solids, nutrients and organic carbon from the various land uses (rice, soybeans, pastureland grazing) within the watershed (short-term)
4. Tracking water quality improvement in the bayou for instance decreases in total organic carbon and increases in total dissolved oxygen (short and long term)
5. Documenting results of the tracking to the Nonpoint Source Interagency Committee, residents within the watershed, and EPA (short and long term)
6. Submitting semi-annual and annual reports to EPA which summarize results of the

watershed restoration actions (short and long term)

7. Revising LDEQ's web-site to include information on the progress made in watershed restoration actions, nonpoint source pollutant load reductions, and water quality improvement in the bayou (short and long term).

9.2 Measures of Success

Project leaders should establish numeric criteria to drive the selection of BMPs based on the ability of such measures to achieve the stated goals of pollutant reduction and citizen participation. The goal of the Clear Lake/Smithport Lake watershed protection plan is to reduce the amounts of non-native aquatic plants and to decrease the concentrations of nitrate/nitrite and total phosphorus conditions. LDEQ is confident that the proposed best management practices along with any additional BMPs that may be found helpful will result in an increase in the dissolved oxygen level. In addition, changes in water quality often are delayed following initial implementation of management measures, and substantive changes generally require several years to be discernable. So, while annual assessments of implementation progress will be made, broader evaluations should be used to direct overall program success, such as:

- **Urban Nonpoint Source Education Programs**
  The success of educational programming targeting urban nonpoint source pollution can be determined by the number of participants in workshops and seminars. Attitude change and resulting actions can be surveyed to determine the effectiveness of outlined programs.

- **Education and Public Outreach Program**
  Public entities and grassroots organizations can develop a public awareness program to educate the public on the rewards of properly managing soil, water, and related resources. Included can be such topics as wetland restoration and preservation, point and nonpoint pollution, etc. The program can include public workshops, printed stickers and brochures, as well as school projects such as poster and essay contests. Ideas and suggestions for this program can be obtained from federal agencies such as EPA, NRCS, and the Louisiana Cooperative Extension Service; state agencies such as LDEQ and LDAF; local groups such as the chamber of commerce; and local businesses, corporations, and industries that are always seeking ways to improve their public relations.

- **Number of Rural Best Management Practices Installed**
  Best management practices for agricultural and rural areas can be targeted at specific subwatersheds based on applicability and funding availability. The total amount of best management practice installation will be measured in linear feet or acres depending on the specific practice outlines.

- **303(d) List status**
  Listing of the Clear Lake/Smithport Lake Watershed on future 303(d) lists will provide a tangible and public method for gauging the overall effectiveness of the host of practices administered.

- **Ambient Water Quality Monitoring Data**
  Direct water quality monitoring from appointed areas within the watershed will allow for an incremental view of the progress achieved by the implemented components of the watershed protection plan. Additionally, this will allow for the revision of ineffective portions of the Plan toward achieving an

improvement in reduction of nutrient and sediment loadings and reduction of invasive plants.

- **Load Reductions**
  The Louisiana Department of Environmental Quality understands the importance of quantifying load reductions on a watershed, waterbody, and project level. However, precise estimates of attainable load reductions are difficult to determine, and may change over time due to significant changes in land use and pollutant sources. LDEQ reviews the status of each waterbody where a TMDL study has been performed, to determine if compliance with applicable surface water quality standards has been achieved. To date, load reductions attained on a watershed or waterbody scale have not been calculated. However, the Nonpoint Source program of the LDEQ is currently working on extracting data concerning load reductions and BMPs from past project final reports, and plan to compile the information in one central area. New information and data collected will also be compiled with that information.

At a project level, the LDEQ is asked to enter estimated load reductions for all 319 funded projects in EPA's Grant Reporting and Tracking System (GRTS) database, if that information is available. If the information and load reduction data is available, it is uploaded as it is received either from grantees or project managers. Again, there are many challenges to this requirement as nonpoint source load reductions are difficult to quantify due to the natural variability and the difficulty in precisely predicting the performance of management measures of BMPs over time. Model projections can be used for measuring load reductions in water quality improvement grant projects. In order to use nonpoint source load reduction models effectively you must know which of the many modeling programs will provide the correct end result. Another challenge is the level of technical information (i.e., hydrology, pollutant loading processes, limitations of environmental data) needed to run a model and is also dependent on whether the grantee or an LDEQ project manager has the particular expertise needed to provide estimates on load reduction. More and more projects on GRTS have load reduction information. Obtaining more load reduction data continues to be a main program focus in fiscal year 2009.

10.0 Summary of Clear Lake/Smithport Lake Watershed Implementation Plan

Clear Lake/Smithport Lake does not meet the water quality standards for dissolved oxygen and nutrients. With the aim of restoring its designated use of fish and wildlife propagation, the models indicate that there needs to be a watershed-wide 100% decrease in man-made nonpoint sources and 40% reduction of background loads in order to meet the DO criterion of 5.0 mg/L in the summer critical season. A use-attainability analysis is needed for this area. To meet this goal, a collaborative effort from the citizens of the area, special interest groups, and the government, is essential. These problems should be addressed through basin-wide educational programs encompassing restoration and management strategies for pastureland, nutrients, forestry, non-native aquatic plants, and hydromodification. Best Management Practices and regulations are available for reducing nonpoint source pollutant loads from these causes; and if followed properly, should reduce most of the suspected causes of impairments in the watershed. Financial support can be provided for some of these activities through USEPA §319(h) funds or by financial, technical, or educational assistance through the USDA.

The short-term goal for managing these water quality problems is to work with the local community, decision-makers, state and federal agencies to implement management measures and best management practices that can reduce the concentration of sediment and nutrients leaving the land during rain fall events, and reducing invasive species.

The long-term water quality goal is to be able to measure a reduction in the in-stream concentration of these pollutants and to restore the designated uses for the water body. From the implementation of this watershed plan, LDEQ expects to gain better working relationships among organizations; a better use of science to understand how human activities affect our water resources; a better protection for our water bodies; and most importantly, cleaner water. Ultimately this responsibility lies on the shoulders of everyone who lives, works or plays in the Clear Lake/Smithport Lake Watershed. Public participation is critical throughout plan development and implementation, as ultimate success of any Watershed Protection Plan depends on stewardship of the land and water resources by landowners, businesses, and residents of the watershed. The Clear Lake/Smithport Lake Watershed Protection Plan defines a strategy and identifies opportunities for widespread participation of stakeholders across the watershed to work together and as individuals to implement voluntary practices and programs that restore and protect water quality in the watershed.

The LDEQ is continuing to implement a watershed approach to the surface water quality monitoring. In 2004, a four year sampling cycle replaced the previous five year cycle. Approximately one quarter of the state's watersheds will be sampled in each year so that all of the state's watersheds will be sampled within the four year cycle. This will allow the LDEQ to determine whether there has been any improvement in water quality following implementation of the TMDLs. The implementation of best management practices to control and reduce runoff of soil and oxygen-demanding pollutants from nonpoint sources in the watershed will control and reduce the nutrient loading from the suspected sources. As the monitoring results are evaluated at the end of each year, waterbodies may be added to or removed from the 303(d) list. The Plan will act as a living document; subject to revision as the performance is evaluated.

Figure 32 Clear/Smithport Lake

Although some of the BMPs and their recommended courses of action were described within this plan, a consolidated list of BMPs recommended for each of these land uses can be viewed in the State of Louisiana Water Quality Management Plan, Volume 6 (LDEQ, 2000). Detailed BMP manuals for agronomic crops, rice, poultry, sugar cane, dairy, sweet potato, swine, beef, and aquaculture have been produced by LSU AgCenter and are available on their website http://www.lsuagcenter.com/Subjects/bmp/index.asp. For all entities involved in silvicultural operations, the Recommended Forestry Best Management Practices for Louisiana manual has been and will continue to be an invaluable source of information and recommendations (LDEQ, 2000).

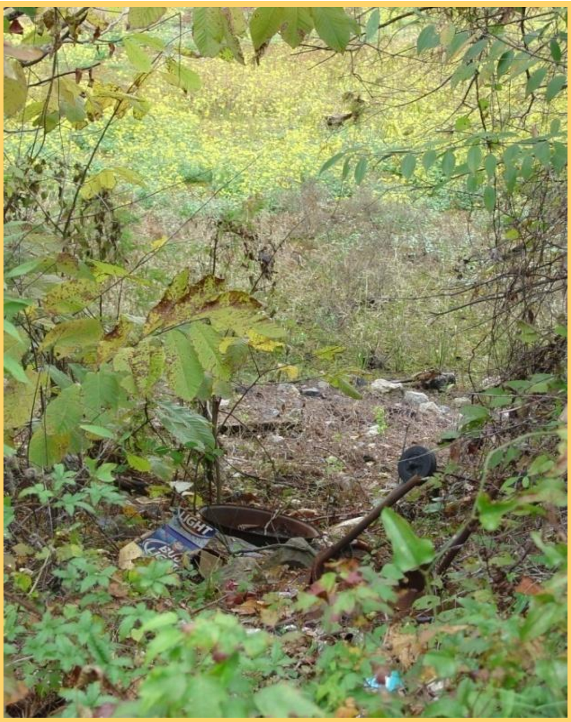


Figure 33 Trash on the Smithport Dam

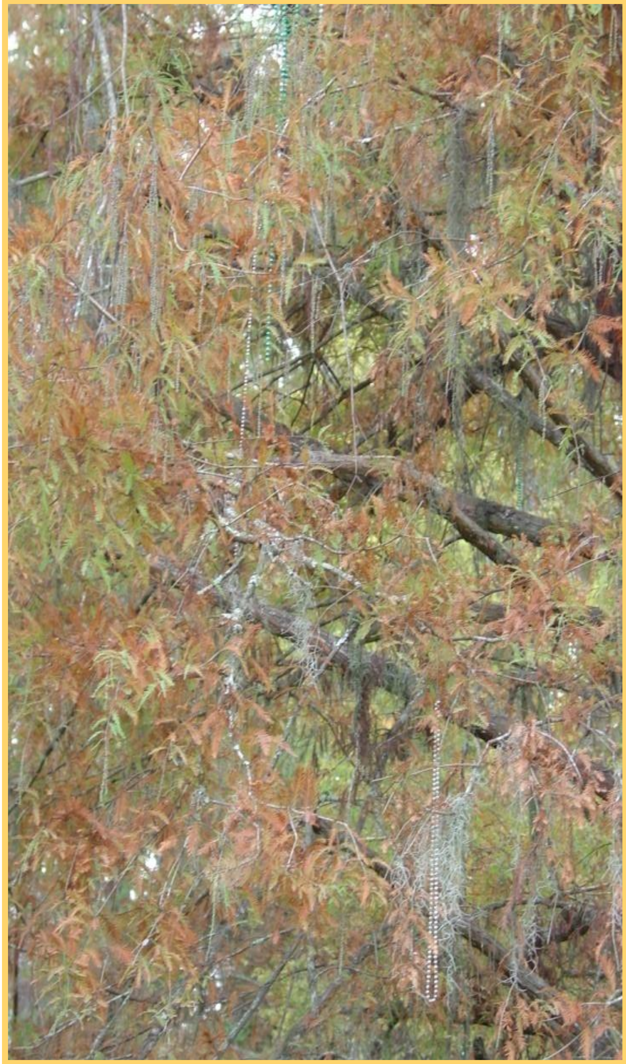


Figure 34 Mardi Gras beads in trees of the Clear/Smithport Lake forested area!

Appendices

Appendix A

Elements of Successful Watershed Plans

A. Identification of Causes and Sources of Impairment

An identification of the causes and sources or groups of similar sources that will need to be controlled to achieve the load reductions estimated in the watershed-based plan (and to achieve any other watershed goals identified in the watershed-based plan). Sources that need to be controlled should be identified at the significant subcategory level with estimates of the extent to which they are present in the watershed. Information can be based on a watershed inventory, extrapolated from a subwatershed inventory, aerial photos, GIS data, and other sources.

B. Expected Load Reductions

An estimate of the load reductions expected for the management measures proposed as part of the watershed plan. Percent reductions can be used in conjunction with a current or known load.

C. Proposed Management Measures

A description of the management measures that will need to be implemented to achieve the estimated load reductions and an identification (using a map or description) of the critical areas in which those measures will be needed to implement the plan. These are defined as including BMPs (best management practices) and measures needed to institutionalize changes. A critical area should be determined for each combination of source and BMP.

D. Technical and Financial Assistance Needs

An estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan. Authorities include the specific state or local legislation which allows, prohibits, or requires an activity.

E. Information, Education, and Public Participation Component

Any information/education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the NPS management measures that will be implemented.

F. Schedule

A schedule for implementing the NPS management measures identified in the plan that is reasonably expeditious. Specific dates are generally not required.

G. Milestones

Any description of interim, measurable milestones for determining whether NPS management measures or other control actions are being implemented. Milestones should be tied to the progress of the plan to determine if it is moving in the right direction.

H. Load Reduction Evaluation Criteria

A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made towards attaining water quality standards and, if not, the criteria for determining whether the watershed-based plan needs to be revised. The criteria for loading reductions do not have to be based on analytical water quality monitoring results. Rather, indicators of overall water quality from other programs can be used. The criteria for the plan needing revision should be based on the milestones and water quality changes.

I. Monitoring Component

A monitoring component to evaluate effectiveness of the implementation efforts over time, measured against the criteria established under the evaluation criteria. The monitoring component should include required project-specific needs, the evaluation criteria, and local monitoring efforts. It should also be tied to the State water quality monitoring efforts.

Appendix B

The issues involved in selection of methods for quantifying efficiency, performance, and effectiveness are complex. It would be difficult, at best, to find one method that would cover the data analysis requirements for the widely varied collection of BMP types and designs found in the International Stormwater BMP Database. The difficulty in selection of measures of efficiency stems not only from the desire to compare a wide range of BMPs, but also from the large number of methods currently in use. There is much variation and disagreement in the literature about what measure of efficiency is best applied. The estimation of the efficiency of BMPs is often approached in different ways based on the goals of the researcher. A BMP can be evaluated by itself or as part of an overall BMP system. The efficiency of a BMP not including bypass or overflow may be dramatically different than the efficiency of an overall system. The efficiency of a BMP system or a BMP can be directly affected by the way in which an operator chooses to manage the system. This is the case where parameters of a design can be adjusted, (e.g., adjustments to the height of an overflow/bypass weir or gate). These adjustments can vary the efficiency considerably. In order to analyze a BMP or BMP system thoroughly, all static and state variables of the system must be known.

According to the International Storm water BMP Database, http://www.bmpdatabase.org/Docs/FAQPercentRemoval.pdf , The BMP Database Project Team is frequently asked why percent removal is not used to assess best management practice performance for the BMP database project. The website goes on to summarize some of the shortcomings associated with percent removal as a tool to assess BMP performance. It was stated that they "recognize that percent removal is an easy-to-understand concept that is attractive to many entities", but they "believe that the following shortcomings are significant and require an alternative measure (or measures) of BMP performance".

1. Percent removal is primarily a function of influent quality. In almost all cases, higher influent pollutant concentrations into functioning BMPs result in reporting of higher pollutant removals than those with cleaner influent. In other words, use of percent removal may be more reflective of how "dirty" the influent water is than how well the BMP is actually performing. Therefore (and ironically), to maximize percent removal, the catchment upstream should be "dirty" (which does not encourage use of good source controls or a "treatment train" design approach).
2. Significant variations in percent removal may occur for BMPs providing consistently good effluent quality. Stated differently, the variability in percent removal is almost always much broader than the uncertainty of effluent pollutant concentrations. These variations in percent removal have little relationship to the effluent quality achieved.
3. BMPs with high percent removal (e.g., >80% removal of TSS) may have unacceptably high concentrations of pollutants in effluent (e.g., >100 mg/L TSS), which can lead to a false determination that BMPs are performing well or are "acceptable," when in fact, they are not.
4. Various relationships between influent and effluent concentrations have been demonstrated for a variety of BMPs and designs. The relationships are often complex and are not well represented by a single ratio of inflow to outflow concentrations. In addition, many BMPs that are functioning well appear to reach an irreducible concentration. Any measure of BMP performance should be

universally interpretable regardless of influent concentration, BMP function, design, number of samples collected, etc.

5. Methods for calculating percent removal are inconsistent (e.g., event by event, mean of event percent removals, inflow median to outflow median, inflow load to outflow load, slope of regression of loads, slope of regression of concentrations). Very different percent removals can be reported from the same data set.
6. Frequently, in many methods, percent removal is dominated by outliers or high concentration events in a series that have high leverage on an average. The standard reporting of percent removal carries none of the statistical support needed to assess uncertainty in the reported value.
7. Many BMPs that have been monitored do not have enough data to reject the null hypothesis that the influent and effluent concentrations are even different from one another (i.e., we cannot tell if the BMP reduces anything), yet these numbers are published as indicative of performance. Some studies have reported small percent increases in performance erroneously when in fact, the influent and effluent concentrations are not statistically different from one another.
8. When percent removals are applied in modeling efforts, the resulting estimated effluent concentrations can be very misleading—particularly when the effluent quality predicted has not been observed in data sets for the practice being modeled.
9. Many volume-based BMPs have long-term performance that is not evident if a paired inflow-outflow percent removal approach is taken (i.e., material from one event is discharged in another).
10. In terms of meeting receiving water standards, BMP discharges can comply with receiving water numeric targets while simultaneously not showing favorable percent removals.
11. Range of expected effluent quality concentrations is a much better planning and design tool than percent removal estimates. For example, an engineer can use effluent concentrations as a tool to estimate the range of pollutant loading that could be expected at a new development. This is particularly important in sensitive watersheds where it is important to have confidence that BMPs will be adequately protective.
12. Requirement to use percent removals to assess BMP performance can bias monitoring designs. In effect, incentive is provided to monitor BMPs at relatively dirty locations or areas with poor source controls in place, so that the BMP performance "looks better." The Project Team has seen this intentionally done.
13. Percent removal does not provide a meaningful mechanism to address the well-established concept of irreducible pollutant concentrations expressed by Schueler in Center for Watershed Protection publications (See "Article 65 Irreducible Concentrations Discharged from Storm water Practices" in the *Practice of Watershed Protection*).
14. Percent removals do not adequately reflect the effect of volume reductions. In some percent removal calculation methods, volume reductions are partially taken into account, but not in others. Even when load reductions are used, this approach misses the benefit of the reduced frequency of discharges.
15. Percent removal methods also sometimes miss the measurement of how much runoff is and is not treated. There are example studies where the percent removal has been reported based upon the influent and low-flow effluent (e.g., the flow stream that has

received treatment) from a BMP; however, the majority of flow was bypassing the BMP due to clogging. BMP sizing relative to incoming runoff is important in performance metrics.

For these reasons, among others, the Project Team does not present percent removal estimates with the BMP analysis it conducts. Instead, the Team recommends using an approach that focuses on:

- How much the BMP reduces runoff volumes
- How much runoff is treated (versus bypassed)
- Whether the BMP can demonstrate a statistical difference in effluent quality compared to influent quality
- What distribution of effluent quality is achieved
- How well the BMP reduces peak runoff rates, especially for smaller, frequent storms (which helps to reduce hydromodification)

LDEQ does recognize that having information pertaining to percent removal/effectiveness of a BMP is a clear and easy way to decide on a suitable best management practice. On pages 59-61, tables can be found showing BMPs and their effectiveness according to the Louisiana Department of Agriculture and Forestry, and on pages 62-63, tables can be found showing Pollutant Reduction Performances taken from the Cedar Creek Watershed Protection Plan, page s 45-47.

Figure 35 Boat ramp into Clear/Smithport Lake

Pastureland Best Management Practices Effectiveness

BMP	Targeted Pollutant in Surface Water	Effectiveness of BMP
Pasture & hayland planting	Sediment	substantial
Irrigation water management	Sediment	substantial
Critical area planting	Sediment	substantial
Fencing to distribute grazing	Sediment	neutral
Prescribed Grazing	Sediment	substantial
Mechanical Forage Harvest	Sediment	moderate
Irrigation water conveyance	Sediment	moderate
Appropriate irrigation system	Sediment	moderate
Filter strip/buffer	Sediment	moderate
Pond to distribute grazing	Sediment	slight-substantial
Spring development to distribute grazing	Sediment	slight
Brush management	Sediment	slight
Nutrient management	Nutrients	substantial
Waste Utilization	Nutrients	substantial
Irrigation water management	Nutrients	substantial
Pasture & hayland planting	Nutrients	substantial
Use Exclusion to exclude livestock from streams	Nutrients	neutral
Pond	Nutrients	slight-moderate
Buffers	Nutrients	slight-substantial
Fencing to distribute grazing	Nutrients	neutral
Prescribed Grazing	Nutrients	moderate
Forage harvest mgt.	Nutrients	slight-moderate
Waste utilization	Oxygen Demand	moderate
Pond	Oxygen Demand	slight
Nutrient management	Oxygen Demand	substantial
Use Exclusion to exclude livestock from streams	Oxygen Demand	slight-moderate
Fencing to distribute grazing	Oxygen Demand	neutral
Filter strip/buffers	Oxygen Demand	substantial
Prescribed grazing	Oxygen Demand	slight
Forage harvest management	Oxygen Demand	slight
Pasture and hayland planting	Oxygen Demand	slight
Irrigation water management	Oxygen Demand	slight
Waste utilization	Bacteria	neutral
Pond	Bacteria	slight worsening
Nutrient management	Bacteria	slight
Filter strip/buffers	Bacteria	slight
Spring development to distribute grazing	Bacteria	slight
Irrigation water management	Bacteria	substantial

Cropland Best Management Practices Effectiveness

BMP	Targeted Pollutant in Surface Water	Effectiveness of BMP	Crops
Mulch Till	Sediment	slight	1,2,4-6
No Till	Sediment	moderate	1,2,4-6
Ridge Till	Sediment	slight-moderate	1-3,5,6
Contour farming	Sediment	moderate	1,2,5,6
Grassed waterway	Sediment	slight-moderate	1-6
Residue Mgt.,Seasonal	Sediment	slight	1-6
Grade stab strut.	Sediment	slight-moderate	1-6
Cons. crop. rot.	Sediment	slight-moderate	1-6
Irrig.Water mgt.	Sediment	moderate	1-6
Tailwater rec.	Sediment	slight	1-6
Struct. water cont.	Sediment	slight	1-6
Water & sed. basin	Sediment	moderate-substantial	1,2,5,6
Sediment basin	Sediment	substantial	1,2,5,6
Irrig. leveling	Sediment	slight	1-6
Field border	Sediment	slight-moderate	1,2,5,6*
Cover crop	Sediment	slight-moderate	1-6
Deep Tillage	Sediment	slight-moderate	1-6
Filter strips/buffers	Sediment	substantial	1,2,4-6*
Diversion	Sediment	medium	1,2,5,6
Nutrient Mgt.	Soluble Nutrients	substantial	1-6
Waste utilization	Soluble Nutrients	slight	1-6
Irrig.Water mgt.	Soluble Nutrients	slight	1-6
Tailwater rec.	Soluble Nutrients	slight	1-6
Land leveling	Soluble Nutrients	slight	1-6
Irrig. system	Soluble Nutrients	slight	1-6
Field border	Soluble Nutrients	slight	1-6*
Cover crop	Soluble Nutrients	slight	1-6
Deep tillage	Soluble Nutrients	slight	1-6
Cons. crop. rot.	Soluble Nutrients	slight	1-6
Mulch till	Soluble Nutrients	slight	1,2,4-6
No till	Soluble Nutrients	slight	1,2,4-6
Ridge till	Soluble Nutrients	slight	1-6
Crop residue,Seasonal	Soluble Nutrients	slight	1-6
Water & sed. basin	Soluble Nutrients	slight	1,2,5,6
Terrace	Soluble Nutrients	slight	1,2,5,6
Sediment basin	Soluble Nutrients	substantial	1,2,5,6
Filter strips/buffers	Soluble Nutrients	substantial	1-6*
Contour farming	Soluble Nutrients	slight	1,2,5,6
Stripcropping	Soluble Nutrients	slight	1,2,5,6
Grassed waterway	Soluble Nutrients	slight	1-6 ***
Waste utilization	Adsorbed Nutrients	moderate	1-6
Irrig.Water mgt.	Adsorbed Nutrients	substantial	1-6
Tailwater rec.	Adsorbed Nutrients	moderate	1-6
Land leveling	Adsorbed Nutrients	moderate	1-6
Irrig. system	Adsorbed Nutrients	substantial	1-6
Field border	Adsorbed Nutrients	moderate	1-6*
Cover crop	Adsorbed Nutrients	moderate	1-6
Deep tillage	Adsorbed Nutrients	substantial	1-6
Cons. crop. rot.	Adsorbed Nutrients	moderate	1-6

Mulch till	Adsorbed Nutrients	moderate	1,2,4-6
No till	Adsorbed Nutrients	slight	1,2,4-6
Ridge till	Adsorbed Nutrients	slight	1-6
Crop residue Seasonal	Adsorbed Nutrients	slight	1-6
Water & sed. basin	Adsorbed Nutrients	moderate	1,2,5,6
Terrace	Adsorbed Nutrients	moderate	1,2,5,6
Contour farming	Adsorbed Nutrients	substantial	1,2,5,6
Stripcropping	Adsorbed Nutrients	substantial	1,2,5,6
Grassed waterway	Adsorbed Nutrients	moderate	1-6 ***
Waste utilization	Oxygen Demand	slight	1-6
Field border	Oxygen Demand	mod	1,2,5,6*
Filter strips/buffers	Oxygen Demand	sub	1,2,5,6*
Terrace	Oxygen Demand	moderate	1,2,5,6
Contour farming	Oxygen Demand	mod	1,2,5,6
Stripcropping	Oxygen Demand	mod	1,2,5,6
Water & sed. basin	Oxygen Demand	mod	1,2,5,6
Sediment basin	Oxygen Demand	sub	1,2,5,6
Diversion	Oxygen Demand	neutral	1,2,5,6
Irrig Water mgt.	Oxygen Demand	slight	1-6
Irrig. system	Oxygen Demand	slight	1-6
Deep tillage	Oxygen Demand	slight	1-6
Waste utilization	Bacteria	neutral	1-6
Field border	Bacteria	slight	1,2,5,6*
Filter strips/buffers	Bacteria	slight	1,2,5,6*
Terrace	Bacteria	moderate	1,2,5,6
Contour farming	Bacteria	slight	1,2,5,6
Stripcropping	Bacteria	slight	1,2,5,6
Water & sed. basin	Bacteria	slight	1,2,5,6
Sediment basin	Bacteria	mod	1,2,5,6
Diversion	Bacteria	slight	1,2,5,6
Irrig Water mgt.	Bacteria	substantial	1-6
Irrig. system	Bacteria	slight	1-6
Deep tillage	Bacteria	slight	1-6

1 = cotton, 2 = soybeans, 3 = sugarcane, 4 = rice, 5 = corn, 6 = truck crops
* Fields not artificially drained.
**Fields not artificially drained.
*** Chemical maintenance of vegetation may adversely affect the quality of runoff water.

Pollutant Reduction Performance of Best Management Practices

Practice	Area (hectares)	Length (km)	% Sediment Reduction	% N Reduction	% P Reduction
Cropland BMPs					
Terrace(Practice #600) (Cropland with >=2% slope)	4,386.34		-7%	-1.5%	-7%
Contour Farming (Practice #330) (Cropland with >=2% slope)	4,386.34		-6%	-1%	-6%
Crop Residue Management (Practice #329, 344, 345, 346) (Conventional till to minimum till)	16,104.80		-5.3%	-2.5%	-3.5%
Conversion of Cropland to Grass—Pasture Planting(Practice #512)	16,104.80		-28%	-18.5%	-35%
Grassed Waterway (Practice #412) (In 14 subbasins with more than 10% cropland)	35,112.2733 Tributary channel length 186.6km		-5%	-2.75%	-1.6%
Filter Strips (Practice #393) (15m width)	16,104.80		-22%	-17%	-30%
Fertilizer/Nutrient Management (Practice #590) [25% reduction in Mineral P application (25kg/ha) in cropland] (Actual N rate: 67kg/ha; P—34 kg/ha)	16,104.80		0%	0%	-2%
Pasture and Rangeland BMPs					
Prescribed Grazing (Practice #528)	165,919.70		-8%	-15.6%	-5.6%
Fencing (Practice #382)					
Water Facility (Practice #614)					
Fertilizer/Nutrient Management (Practice #590) [25% reduction in Nitrogen application (50 kg/ha) in Pasutreland] (Actual N rate:67 kg/ha)	165,919.70		0%	-3%	0%
Pasture Planting (Practice #512)	165,919.70		-8%	-15.6%	-5.6%
Range Planting (Practice #550)					
Grassed Waterways (Practice #412) (In 33 subbasins with more than 75% Pasture; total tributary channel length of 409.3km)	83,819.4414		-4%	-6%	-2%

Practice	Area (hectares)	Length (km)	% Sediment Reduction	% N Reduction	% P Reduction
Urban Nutrient BMP					
Actual fertilizer rate: Nitrogen: 190 kg/ha Phosphorus: 30kg/ha Reduced to: Nitrogen: 50kg/ha Phosphorus: 2.5 kg/ha	16,636.62		0%	-10%	-13%
Channel BMPs					
Riparian Buffer Strips (Practice #390,391)		653.887	-23%	-4.3%	-5.3%
On or Off Channel Water and Sediment Control Basin (Practice #638)	Assume 53 structures, each with a max surface area of 3.5 hectares and a volume of 195,000m³		-1.6%	-0.4%	-0.2%
Channel Stabilization (Practice #584)		653.887	-23%	-4.3%	-5.3%
Streambank and Shoreline Protection (Practice #580)		653.887	-23%	-4.3%	-5.3%
Watershed BMPs					
Wetland Creation (Practice #658)					
Grade Stabilization Structures (Practice #410)	33,051.5442 (Assume building a small drop structure per 1000ha; 33 structures approximately)		-2.4%	-1.6%	-2.3%
2050 scenario 3% cropland and 3% pasture to urban 2050 WWTP loads (i.e. urban area almost doubles)	16,636.62		-7%	-7%	-11%
2050 scenario with urban nutrient BMP	16,636.62		-7%	-16%	-21%

Appendix C

Cost of BMP Implementation

Practice Code	Practice Name	Component	Unit Type	2008 State Average Cost ($)
100	Comprehensive Nutrient Management Plan	Comprehensive Nutrient Management Plan	no	350.00
327	Conservation Cover	Native species, 1 to 2 species (seedbed prep, seed, planting)	ac	92.00
329	Residue and Tillage Management, No-Till/Strip-Till/Direct Seed	No Till	ac	25.00
330	Contour Farming	Contour Farming	ac	5.00
338	Prescribed Burning	Prescribed Burning	ac	25.00
340	Cover crop	Establishment of small grain for seasonal cover	ac	31.00
342	Critical Area Planting	Establishment of permanent cover (seedbed Prep, seed, and seeding)	ac	210.00
350	Sediment Basin	Sediment Basin (installed, mobilization, earthwork, outlet structure)	cy	2.45
382	Fence	4 Strand Barbed Wire (materials and labor)	lf	1.63
386	Field Border	Native species, 1 to 2 species (seedbed prep, seed, planting)	ac	92.00
393	Filter Strip	Native species, 1 to 2 species (seedbed prep, seed, planting)	ac	92.00
412	Grassed Waterway	Waterway (installed, mobilization, excavation)	cy	2.10
462	Precision Land Forming	125 to 205 cy per ac (installed , mobilization, earthwork)	ac	252.00
464	Irrigation Land Leveling	125 to 205 cy per ac (installed , mobilization, earthwork)	ac	252.00
490	Forest Site Preparation	Afforestation Mechanical-(Bushhogging)	ac	20.00
490	Forest Site Preparation	Reforestation Mechanical-(Deep Tillage)	ac	146.00
512	Pasture and Hayland Planting	Seeding Introduced Species (seed, seedbed preparation, planting)	ac	61.25
528	Prescribed Grazing	Deferred Grazing	ac	50.00
533	Pumping Plant	Nose Pump for livestock water (pump, suction hose, foot valve, platform)	ea	572.00
561	Heavy Use Area Protection	Heavy Use Area - all surface material types (installed, mobilization, earthwork, all materials)	sf	3.00
575	Animal Trails and Walkways	Livestock Water Access Point - all surface material types (installed, mobilization, earthwork, all materials)	sf	3.00

578	Stream Crossing	Concrete low water crossing (installed, mobilization, crossing surface, earthwork)	lf	93.00
580	Streambank and Shoreline Protection	Shoreline Protection Vegetative Plantings (installed, mobilization, earthwork, plants)	lf	12.96
590	Nutrient Management	Precision Agriculture - with Yield Monitor	ac	36.00
601	Vegetative Barrier	Native species (seedbed prep, seed, planting)	lf	0.05
612	Tree/Shrub Establishment	Hardwood Bare Root Seedlings (Riparian Forest Buffer ONLY) (Planting included)	ac	135.00
614	Watering Facility	Permanent Water Trough 50 to 100 Gal (installed, materials)	ea	150.00
638	Water and Sediment Control Basin	Water and Sediment Control Basin (installed, mobilization, earthwork, outlet structure)	cy	2.40
655	Forest Harvest Trails & Landings	Broad Based Dip (installed, mobilization, earthwork)	ea	130.00
655	Forest Harvest Trails & Landings	Rolling Dip (installed, mobilization, earthwork)	ea	105.00
655	Forest Harvest Trails & Landings	Waterbar (installed, mobilization, earthwork)	ea	75.00
655	Forest Harvest Trails & Landings	Wing Ditch (installed, mobilization, earthwork)	ea	78.00
666	Forest Stand Improvement	Post Plant Weed Suppression Light Competition	ac	47.00
666	Forest Stand Improvement	Precommercial thinning	ac	140.00
717	Livestock Shade Structure	Livestock Portable Shade Structure	sf	4.60

ac=acre ea=each lf=linear feet sf= square feet cy=cubic yard

Figure 36 Clear/Smithport Lake covered in Salvinia area!

Figure 36 Water leaving Smithport Lake dam and entering Bayou Pierre Lake

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